

Report of the Jorhat Agricultural Experiment Station for the year ending 31st March 1920.

I. Introduction.—This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, and was established at the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of most *rabi* crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factor causing this sterile condition with a view to its amelioration. This work has been going on since 1908, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather, and also to certain crops in the rains, is due to the accumulation of acid substances, amongst them being a specific toxin which has been isolated and experimented within culture solutions, with effects on the plant's root system and growth precisely similar to those observed in the field; these are readily neutralised and rendered harmless by dressings of lime or other base to the soil. An account of the experimental results leading up to this conclusion has been published as a memoir of the Department of Agriculture in India, Chemical Series, Volume III, No. 9, entitled "Studies of an acid soil in Assam."

In connection with the improvement of the soil by liming, the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of raw phosphates. Phosphoric acid has an effect second only to that of lime on these soils, but is preferably used in a basic form such as basic slag, for instance, rather than in the form of acid superphosphate. While small initial applications of the latter act beneficially, its application in very large doses or its continued use over a number of years in our own experience is clearly detrimental in the absence of periodic lime dressings on sour soils. If used in conjunction with lime, however, the case is quite a different one.

The original area of the station was about $35\frac{1}{2}$ acres, of which 1.7 acres is *hola* or ravine land and the remainder high land, which was under grass and scrub jungle at the time of acquisition. An additional area of about 24 acres has since been acquired, of which about 4 acres is *hola* land and the remainder high land.

The total area at present is thus $.59\frac{1}{2}$ acres. Most of the newly-added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. Soil.—The soil of the high land is a reddish sandy lo of the old alluvium, lying on a hard greyish yellow sub-s. Where the conditions have not been improved by cultivation the soil is extremely shallow, varying from only 3 to 6 inches depth :—

Report on analysis of Jorhat Farm soil.

	Surface soil.	Sub-soil	
	Laboratory No. 5.	Laboratory No. 5(a)	
1	2	3	
A	Per cent.	Per cent.	
<i>Soluble in Hydrochloric acid with 12 hours' digestion at 100° C.</i>			
Phosphoric acid (P_2O_5)	... ...	0·025	0·0
Potash (K_2O)	... ...	0·115	0·1
Lime (CaO)	... ...	0·154	0·3
Magnesia (MgO)	... ...	0·166	0·1
B			
<i>Soluble in one per cent. citric acid with 7 days' digestion.</i>			
Phosphoric acid	... ...	0·008	0·1
Potash	... ...	0·007	0·0
C			
<i>Loss on ignition (organic matter and combined water)</i>			
Nitrogen	... ...	8·26	1·8
Calcium carbonate	... ...	0·115	0·0
Reaction	... ...	0·018	Acid

These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime, is deficient in quantity.

The amount of organic matter is probably greater than obtains many Indian soils, but there is no doubt that a light soil of character will be much improved in many ways by an ease in the amount of humus.

A good deal of the organic matter present is of a doubtful character and consists very probably of very old residues of little use; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one, but in view of the absence in anything like adequate quantity of carbonate of lime, conditions for nitrification and soil bio-chemical processes generally probably not as favourable as they might be by a long way, an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in "total" as well as "available" supplies. There is thus a real "as opposed to a mere temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and magnesia, high percentages of which may, and often do, offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself, very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element and to respond to its suitable application.

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crop will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deepened so that the green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface has been deepened and the amount of humus increased, it is little use attempting manurial experiments on cane with

artificial manures. No amount or combination of the latter can ever make up, in the case of a crop like sugarcane, for loss of fertility due to shallow cultivation and lack of "humus".

3. *Buildings, machinery, etc.*—The farm is provided with a godown, combined office and rest-house, Manager's bungalow, clerk's and apprentices' quarters, cattle shed, Dutch barn, manure shed, etc., and is enclosed by "Ideal" wire fencing.

A Hornsby oil engine and crushing-mill capable of dealing with 1 ton of cane per hour was installed in 1911 and has given every satisfaction ever since.

No new construction work was undertaken during the year.

4. *Rainfall.*—The rainfall recorded during the year under report is given below together with the normal rainfall for each month :—

Month.		Actual.	Normal.
1919 April	...	7.62	8.54
" May	...	7.90	9.26
" June	...	24.15	11.36
" July	...	19.05	14.76
" August	...	14.69	15.15
" September	...	14.46	9.18
" October	...	4.75	4.07
" November	...	0.70	0.69
" December	...	0.11	0.52
1920 January	...	0.02	0.03
" February	...	2.54	1.32
" March	...	7.38	3.99
	Total	103.37	79.68

The rainfall was thus in considerable excess over the normal. There was an actual deficiency up till the end of May. During the period June—October there was a very considerable excess over normal. It was distinctly a good growing year for cane but the excessive rain towards the end of the year carried its growth on into the cold weather when the crop should have been ripening off. Consequently though big crops resulted, the quality of the cane was not so good as usual.

5. *Experimental work.*—The work of previous years was continued and extended as follows :—

I. Sugarcane experiments—varietal, manurial and introduction of new varieties.

II. Soil investigation and manurial experiments.

III. Trials of new crops or new varieties—pulses, green crops, etc.

IV. Trials of fodder grasses.

6. *Sugarcane*.—This work includes the importation, testing and selection of varieties under chemical control, manurial experiments in the cane rotation, and the distribution of suitable varieties to cultivators. This year some 65,000 setts were distributed from the farm chiefly Striped Mauritius, B376, B147, and J33a, which was sent out for the first time. The latter is a cane that should generally suit cultivators' conditions, but on account of its hardness will only be approved of by those owning iron mills. It is certainly not a chewing cane.

Speaking generally the cane crops made fine growth during the year and were generally healthy and free from disease. The excessive rainfall in September and October however kept the crop growing longer than usual, and this combined with long continued foggy weather in the cold season delayed ripening with the result that the canes, more particularly the ratoons, were not ripe at harvest time.

7. *Sugarcane varieties—Ratoon cane*.—The following 10 varieties planted in Block E in 1918 were ratooned:—B147, Striped Mauritius, B376, Barbadoes A, B6450, B3412, J33a, Barbadoes B, Magh Sport, and the local variety Magh. The results of the plant cane crop appeared in paragraph 8 of last year's report.

The trash from the plant cane harvest was burnt on the plots. Inter-cultivation was done by single bullock using a three-tyned spring cultivator; this is a very useful implement for inter-cultivation of cane planted 4 feet or more apart.

The crop was given 2,400 lbs. rape cake per acre applied in three dressings at earthing up. The crop was badly laid in places by heavy storms in September. The plots were harvested during the latter part of January and early February 1920. At this time these ratoons were only a little over 10 months old, and not ripe. The late season rains kept the crop growing when it should have been ripening off, and the heavy fogs which persisted right into February retarded ripening. Added to this a great deal of damage was caused by storms and rats in these ratoons resulting in many broken and fermented canes. The figures for juice composition are therefore not as good as usual, those for sucrose in juice and purity being low, while the invert sugar and glucose ratio are higher than usual.

The results appear in Tables I and II.

As the figures show, the can yields were quite fair, the average for the whole 10 varieties being over 22 tons striped cane per acre, while the verage for the better varieties was of course above this figure. Again B147 fell behind Striped Mauritius and B376 as a ratoonner.

The largest crop and the biggest return in sugar per acre were this year given by J33a which produced a fine ratoon crop averaging 37 tons per acre and which stood up well, and was free of disease.

Striped Mauritius and B379 were very badly lodged by storms and were consequently more damaged by rats than other varieties; this reduced their crops and sugar returned in juice.

After J33a, another consistently heavy cropper is B3412 though in quality the latter is very inferior.

The local variety Magh continues to compare very unfavourably with all the introduced varieties, alike both in yield and quality.

Phosphated area.—For the whole of the varieties the average yield of cane from the phosphated and non-phosphated areas was almost identical, there being an actual difference of only half a ton per acre in favour of the non-phosphated area.

In the preceding plant cane crop of the previous year the phosphated area gave an average increase of 3 tons cane per acre.

For the two crops therefore, the net increase in favour of the phosphated area is some $2\frac{1}{2}$ tons stripped cane per acre, which is a figure well within the limits of experimental error, and to which no value can therefore be attached.

Block E. Ratoon cane, 1919-20. Varieties (non-phosphated area).

(Figures are per acre.)

TABLE I.

Variety.	Plot No.	Plot area.	Cane (lbs. per acre).	Juice (lbs. or saccharin per acre).	Expression : juice on cane.	Sucrose sugar in juice.	Invert sugar in juice.	Glucose ratio.	Purity coefficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	8	3	4	6	6	7	8	9	10	11	12
B147	...	1 11	#Acre. 1b. 1b. " " "	1b. 30,400 45,620 27,750	1b. 62.6 63.7	Per cent. 13.71	Per cent. 1.24	Per cent. 3.04	Per cent. 84.9	Per cent. 3.207	Very little disease; erect.
Striped Mauritius	...	2 12	" "	60,600 51,440	87,100 31,660	61.2 61.5	13.40	1.27 0.47	84.9	4.007	Badly lodged and damaged by insects, many canes killed in consequence.
BS76	...	3 13	" "	66,600 52,340	54,350 32,650	60.8 62.0	12.15	1.38 11.19	83.8	4.071	
Barbados A	...	4 14	" "	63,200 64,800	37,760 42,120	59.7 64.9	10.47	2.36 29.54	74.6	4.168	Lodging somewhat. Little disease.
BS450	...	5 15	" "	34,380 32,400	21,350 21,140	62.0 65.2	11.15	1.37 14.08	79.6	2.967	Lodging a little. Somewhat damaged by rats.

TABLE I—concl'd.

Block E. Ratoon cane, 1918-20. Varieties (non-phosphated area).

(Figures are per acre.)

Variety.	Pot No.	Plot area.	Cane (lbs. per acre).	Juice (lbs. per acre).	Express. juice on cane.	Sugars in juice.	Invert sugar in juice.	Gumose Ratio.	Purity co-efficient of juice.	Shrubs per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
B2413	6 16	Acre. lbs. 61,510 75,000	Per cent. 63.4 62.6	Per cent. 10.18	Per cent. 2.43	Per cent. 28.77	Per cent. 73.7	Per cent. 116.	Few diseased canes. Little lodging.
Math Sport	7 17	" 22,620 33,620	60.8 62.1	10.07	...	...	73.0	1,670	Erect. Some diseased canes.
JB8a	8 18	" 33,600 88,860	58.4 59.2	15.05	1.68	12.72	62.3	6,024	Erect, no disease.
Barbados B	9 19	47,560 61,510	64.6 64.4	11.63	2.03	17.45	78.6	3,711	Erect. Little disease.
Math	10 20	" 24,140 16,010	58.2 60.3	9.77	2.04	80.89	70.3	1,236	Many dead canes.

TABLE II.
Block E. Ratoon cane, 1919-20. Varieties (Phosphated area).
 (Figures are per acre.)

Variety.	Plot No.	Plot area,	Cane (lbs. per acre).	Juice (lbs. per acre).	Expression juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.	
1	2	3	4	5	6	7	8	9	10	11	12	
		Acre.	Lbs.	Lbs.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Ibs.
B147	...	1a	50th	31,320	20,130	64.1	...	...	...	85.2	...	3,230
	...	11a	"	41,450	26,010	62.7	14.00	...	...	...	...
		2a	"	43,460	33,460	62.6	13.07	...	...	87.9	4.670	
Stripped Maritua	...	13a	"	52,200	33,300	63.9	...	...	...	...	...
		3a	"	60,520	32,250	64.2	12.33	...	...	84.2	4.020	Many of these plots were badly damaged by rats.
		15a	"	41,170	33,000	66.7	...	...	...	...	...
		4a	"	61,750	44,640	65.9	11.98	...	...	76.7	5.085	
Barbados A	...	14a	"	71,800	47,160	63.4	...	...	...	...	...
		5a	"	40,500	25,130	63.4	...	...	...	...	...
		15a	"	96,965	24,350	65.8	...	...	...	...	...

TABLE II—*concluded.*
Block E. Ratoon cane, 1919-20. Varieties (Phosphated area).
(Figures are per acre.)

Variety.	Plot No.	Plot area. Acre.	Cane yield (bales)	Alein (bales) per acre.	Expression ratio on cane.	Sucrose in juice.	Invert sugars in juice.	Glucose ratio.	Purity of juice.	Sucrose per acre expressed in juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
R2412 ...	... 7a ... 10a	... 50 ... 77,350	... 50,220 50,150	... 64.5 64.8	Per cent. 64.5 64.8	Per cent.	Per cent.	Per cent.	Per cent.	lbs.
Magh Sport	... 7a ... 17a	... 50 ... 19,430	... 5,400 12,000	... 61.7	Per cent. 59.2 61.7	Per cent.	Per cent.	Per cent.	Per cent.	lbs.	
J25a ...	... 8a ... 18a	... 50 ... 25,120	... 63,670 45,480	... 62.3	Per cent. 59.7 62.3	Per cent.	Per cent.	Per cent.	Per cent.	lbs.
Burbadoes B	... 9a ... 10a	... 50 ... 63,100	... 37,800 34,800	... 65.1 65.6	Per cent. 65.1 65.6	Per cent.	Per cent.	Per cent.	Per cent.	lbs.	
Magh ...	... 10a ... 20a	... 50 ... 10,140	... 18,450 12,480	... 64.5 63.8	Per cent. 64.5 63.8	Per cent.	Per cent.	Per cent.	Per cent.	lbs.

Many of these plots were
badly damaged by rats.

8. Sugarcane varieties.—Plant cane.—Block B.—Following the usual rotation this block was under dhaincha and oats in 1917, followed by cowpeas and rape in 1918. The land was then fallowed throughout the cold weather until early March 1919, when the cane was planted direct into trenches behind the plough. Previous to sowing cowpeas in 1918 the whole block was given a dressing of ground limestone at the rate of 1,600 lbs. per acre, while one acre received also 560 lbs. Flour Phosphate.

The following ten varieties were planted in duplicate plots on both the phosphated and non-phosphated areas—B147, Striped Mauritius, B376, Barbadoes A, B6450, B3412, J33a, Barbadoes B, Magh Sport and Magh.

With the exception of the local varieties Magh and Magh Sport germination was excellent all over the block.

The cane made fine progress throughout, the season being favourable for growth. All plots were given the same cultivation and manuring which consisted of 20,000 lbs. cowdung in the trenches at planting time followed by 10,000 lbs. cowdung at each of the two earthings. As previously remarked the season was not so favourable for ripening as for growth, and though very heavy crops were harvested in February and March 1920, the canes were not of the usual quality at this time of year. The results are shown in Tables III and IV.

The figures for cane yield show that the average crop was a very heavy one, the average yield for the ten varieties on the phosphated area being 39·5 tons of stripped cane per acre, while on the non-phosphated area it was 37·5 tons. This constitutes a new record for this farm, the nearest previous average being 33·4 tons per acre two years ago.

The difference between duplicate plots of the same variety on either area was unusually great in a few cases for some reason; taken over the whole area, however the average difference between duplicate plots was only slightly over one ton per acre, or less than 3 per cent. of the average crop.

The older varieties B147, Striped Mauritius and B376 continue to yield very heavy crops but the figures for B376 are lower than they should have been. This variety was very badly laid by storms, and some 10 per cent. of the crop was lost owing to lodging and subsequent disease of the damaged canes. Some of the newer varieties proved themselves again to be very heavy croppers notably Barbadoes A, B3412, and J33a, but except J33a they were again disappointing in quality. J33a appears

to be acclimatising well, and promises to be very useful. Barbadoes A gave the biggest crops, the average of four duplicate plots being 50·5 tons per acre.

The highest yield of sucrose per acre in expressed juice was given by B147 with over 11,000 lbs. sucrose per acre, followed closely by Striped Mauritius with over 10,000 and J33a with well over 9,000. B3412 and Barbadoes A also returned, about 10,000 lbs. sucrose in juice, but the juice was less pure and of lower quality in every way than that of B147, Striped Mauritius and J33a.

The following figures are of interest :—

	Yield of cane per acre in lbs.'		
	1919-20.	Average yield of 6 previous years.	
1	2	3	
B147, plant cane	...	99,875	52,890
Striped Mauritius, plant cane	...	98,145	67,867
B378, plant cane	...	75,765	62,450
Magh,	...	78,110	46,353

While the season was admittedly favourable for growth, these high yields this year are we think not to be explained entirely on that ground. As planting material for this year's crop very carefully selected canes had been planted the year previous which provided fine material, and this possibly influenced the results too.

Phosphated area.—The average increase in crop for all the ten varieties on the phosphated area amounted to slightly over 2 tons of stripped cane per acre. This is well within experimental error limits, and no value can be positively attached to such a result.

Four years ago, however, the phosphated area on this block returned an average of four tons of cane per acre less than the unphosphated area, so that the present result is not perhaps without significance.

TABLE III.
Block B. Plant cane, 1919-20. Varieties (non-phosphated area).
(Figures are per acre.)

Variety.	Plot No.	Plot area. Acre. 15th	Cane (lbs. per acre).	Juice (lbs. per acre).	Express- ion on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co- efficient of juices.	Sucrose per acre in pressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
B 147	...	1	105,460	72,300	69.7	68.7	17.23	0.48	2.61	32.2	11,490
	...	11	"	90,340	69,940	67.4					
B 376	...	2	"	74,920	52,080	69.4	13.50	1.10	8.14	86.3	8,965 Lodging badly. Many canes broken by the storm.
	...	12	"	73,550	51,120	69.5					
Striped Mauritius	...	3	"	102,740	70,040	68.1	15.50	0.92	6.91	90.2	9,920 Lodging badly.
	...	13	"	87,000	59,680	68.5					
Barbadoes B	...	4	"	70,140	47,680	67.8	12.40	1.48	11.83	81.7	6,137
	...	14	"	74,060	51,460	69.4					
Barbadoes A	...	5	"	110,560	"	"	"	"	"	"	"
	...	15	"	113,960	"	"	"	"	"	"	

TABLE III—*concl.*
Block B. Plant cane, 1919-20. Varieties (non-phosphated area).
 (Figures are per acre.)

TABLE IV.
Block X. Plant cane, 1919-20. Varieties (phosphated area).
 (Figures are per acre.)

Variety,	Plot No.,	Plot area,	Cane (lbs. per acre),	Juice (lbs. per acre),	Expression juice on cane,	Sucrose in juice,	Invert sugar in juice-juice,	Glucose ratio.	Purity coefficient of juice.	Success per acre in lbs. based on Jucie.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
		Acre.	Ibs.	Ibs.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
3 147 ...	... 11	1 11	102,700 101,000	67,240 63,900	63.4 65.2	16.81 16.78	0.71 0.78	4.32 0.08	89.3 90.0	11,860 11,860	
B 376 ...	... 12	2 12	76,360 75,340	61,720 55,500	67.8 70.9	13.40 13.40	1.21 1.21	0.08 0.08	89.0 89.0	7,188 7,188	Lodging badly.
Striped Mauritius	... 13	3 13	110,440 92,460	75,720 65,000	69.4 70.3	15.04 17.03	0.78 1.03	88.7 88.7	10,560 10,560	Ditto.	
Barbados B	... 14	4 14	70,100 78,120	50,360 55,420	71.8 70.0	12.37 16.77	1.67 1.67	81.8 81.8	6,542 6,542		
Barbados A	... 15	5 15	120,220 108,700	83,040 74,500	68.0 67.8	13.07 13.07	1.8 1.8	82.4 82.4	10,860 10,860		

TABLE IV—concluded.
Block E, Plant cane, 1919-20. Varieties (phosphated area).
 (Figures are per acre.)

Variety.	Plot No.	Plot area.	Cane (lbs. per acre).	Juice (lbs. per acre).	Expression juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per cent. expressed in juice.	Remarks.	
1	2	3	4	5	6	7	8	9	10	11	12	
		Acre.	lbs.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Ibs.
B 6450	...	6 1/3 th	67,240	47.960	71.3	13.73	1.05	7.64	850	6,535		
	...	16	"	77,480	"	"						
		7	"	111,720	75,820	68.0	13.62	1.00	11.07	83.6		10,826
B 3412	17	"	86,760	"	"						
J 33s	8	"	94,900	60,120	63.8	16.17	0.33	5.75	69.3		67.20
	...	18	"	94,040	"	"						
		9	"	77,440	51,040	65.9	14.85	1.29	8.93	84.6		6,840
	...	19	"	87,610	44,400	65.6	14.85	1.29	8.93	84.6		
Magh Sport	...											
	...											
		10	"	78,600	56,310	70.0	20.70	1.03	17.64	74.3		6,808
		20	"	77,480	51,520	70.0	20.70	1.03	17.64	74.3		

9. *New varieties of cane.*—Several new varieties of cane have been introduced into the farm within the past two years. Many of them were grown on a small scale for observation and preliminary analysis during the year. Some show great promise notably D 74 and Co 9.

During January 1920 preliminary analyses of these canes were made, necessarily on relatively small quantities of material, when the crop was but 9—9½ months old with a view to selecting early ripening varieties, with the following results :—

Variety.	Sucrose in juice.		
	Ratoons.	Plant cane.	
		1	2
			Per cent.
Red Sport of Striped Mauritius	14·84
White Mauritius	15·63
Ashy Mauritius	15·8
Mauritius 55	10·47
Ditto 131	18·14
Ditto 90	12·2
Co-1	16·2
Co-6	14·8
Co-9	17·5
J 213	15·58
J 139	14·61
J 36	15·29
J 247	14·0
D 74	13·6
Manjav	15·75
A 1	14·5
A 2 (a)	17·7
W. M. 1	16·15
W. M. 3	12·6
W. M. 4	14·03
Khajua S. V.	10·33
Nagri S.V.	6·42
Bombai S. V. (B 876)	14·9
Dhal S. V.	18·1
Khagri S. V.	16·58

Considering that the canes were less than 10 months old at the time of analysis and that the season was an unfavourable one for ripening some of the above varieties would appear to be promising.

As a result several have been introduced into the variety experiment trials, 1920-21, and the results will appear in the next report.

The five new Java canes received in 1919 were grown in the nursery during the year. Two varieties arrowed as early as November; otherwise they behaved normally. They are being propagated on a larger scale this year for introduction into the variety tests in 1921.

10. Soil investigations and manurial tests.—The various experiments described in previous reports were continued.

The work includes:—

Block G—Liming experiment commenced in 1909.

, C—Liming and manurial experiment; also an experiment in the use of wood ashes, as a soil ameliorant; both commenced in 1911.

, K—Experiments to elucidate the function of lime on our sour old red alluvial soil and to test the action of various manures and mixtures thereof, with and without lime, commenced 1912.

, L—Ground limestone experiment, commenced 1913 to test the effect of incorporating lime with the soil to varying depths.

Blocks E, B, A & D—Experiments in the use of raw mineral phosphate in the sugarcane rotation. For previous details the earlier reports may be consulted.

11. Block G—Lime experiment.—Half this block was limed 11 years ago, and both sections have been regularly and similarly cropped since to see how long the effect of the single application of lime will last.

The cropping this year was cowpeas for green manure in the rains, with oats as a rabi crop. The cowpeas did very much better on the limed section as usual.

Oats germinated well on either section, but completely died off on the unlimed area in the seedling stage. The limed area carried its crop through and matured a small crop. The lime effect is thus clearly marked though 11 years have elapsed since its application, but it appears to be sensibly diminishing. Certain

crops, like rape, gram and *matikulai* which made fair crops on the limed section in the earlier years of the experiment, now fail to mature their grain. For this reason they were omitted from this year's cropping, oats being sown over the whole area.

12. *Block C—Lime and manurial experiment.*—This experiment commenced in 1911, had for its chief object to discover whether lime is best applied in large occasional doses or in more frequent smaller dressings. During the first six years of the experiment each of the limed sections received a total of 2 tons of slackened lime per acre, either (a) as one initial application of 2 tons, or (b) as two equal triennial dressings of 1 ton each, or (c) in six equal annual doses of $\frac{1}{3}$ rd ton each. Since 1917 the experiment has been continued without further use of lime, for residual effect. Briefly it may be said that during the first few years of the experiment the larger and less frequent lime applications returned the biggest crops. By about the 5th year the smaller more frequent dressings were returning larger yields.

The cropping in this the 9th year of the experiment was jowar in the rains followed by rape in the cold weather.

The jowar was cut green in September. Plot 8 suffered to some extent from water-logging and the results are somewhat lower than they would have been in consequence.

The young crop died out at an early stage practically all over the unlimed plots, a few stunted plants only surviving on such plots as were cross-dressed with cowdung.

Rape was sown rather later than it should have been on account of heavy rain. The season too was against it and it made a very poor crop.

The figures for this crop, though very small, are however comparative.

The records appear in Table V.

Lime dressings.—In regard to the differential lime applications the evidence of both crops, but more particularly of the rape, is in this the ninth year again in favour of the smaller more frequent dressings. This has been the experience from the fifth year of the experiment to date.

Cross-dressings.—While bonemeal has apparently little or no effect on the jowar crop, it is a very important factor for rape. For jowar the figures indicate that a good dressing of lime and cowdung is all that is required, but for rape a phosphatic application in some form must be made on this soil.

Value of organic matter.—The aggregate yield for the green-manured area is this year very slightly less than for the ungreen-manured area in spite of the fact that recent laboratory work on the soils of these plots has shown that the average percentage of nitrogen in the soil on the green-manured area is distinctly higher than on the ungreen-manured side. From personal observations during the growing period of the crops I am convinced this result is due to water-logging which occurred to a greater extent on the green-manured area.

The value of nitrogenous organic matter is emphasized by the following analysis of the table:—

	Relative yields of jowar.	
	Cowdung plots.	Non-cowdung plots.
1	2	3
(a) For whole area	280	100
(b) Non-green-manured block separately ...	206	100
(c) Green-manured block separately ...	343	100

Block C.—Ninth Year of Experiment, 1919-1920.
(Figures are per acre).

		Non-green-manned block.						Green-manned block.							
		No lime.	Lime total 4,800 lbs., i.e., 800 lbs. annually for 6 years from 1911-1916.	Lime total 4,800 lbs., i.e., 800 lbs. in 1911 and again in 1914.	No lime.	Lime total 4,800 lbs., i.e., 800 lbs. annually for 6 years from 1911-1916.	Lime total 4,800 lbs., i.e., 800 lbs. in 1911 again in 1914.	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 5.	Plot 6.	Plot 7.	Plot 8.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
A—Nil	...	...	...	...	...	...	...	...	...	...	...	...	...	...
B—Bonemeal 240 lbs. per acre annually to 6th year, i.e., 1911-1916.	M 0	M 0	J 5,781	J 5,904	J 5,658	J 0	M 0	M 0	J 0	J 0	M 0	J 0	M 0	J 0	
C—Bonemeal 240 lbs. per acre annually last 6th year plus 8,000 lbs. annually since 1911.	M 0	M 0	J 9,225	J 11,356	J 10,045	J 348	M 120	M 0	M 90	M 0	M 230	M 110	M 30	J 7,585	
D—Cordgrass 8,000 lbs. annually since 1911.	M 0	M 63	J 11,439	J 12,915	J 13,120	J 1,250	M 30	M 0	M 30	J 9,983					

N. B.—{ J—Green Jowar.
M—Maize grain.

13. *Wood ashes experiment.*—Five plots receive respectively 5, 10, nil, 15 and 20 maunds of wood ashes per annum.

Half of each plot is cross-dressed annually with 100 maunds cowdung per acre.

Past results show that the wood ashes have a very favourable effect on cropping, and emphasize the desirability of cultivators conserving their ashes along with cowdung. This year the cropping was cowpeas in the rains, followed by rape in the cold season. The cowpeas were hoed in for green-manure. Rape was sown out of season on account of late rains and made a miserable show. The only sub-plot to produce a crop was the one receiving 20 maunds ashes *plus* 100 maunds cowdung. This experiment is deserving of more care from the Farm Manager than it generally receives. From the cultivator's point of view it is one of the most important experiments on the Farm.

14. *Block L.—Ground limestone experiments*—commenced in 1913 on very infertile newly broken up land, this experiment was continued in its 7th year. The scheme consists of 6 plots, each $\frac{1}{3}$ acre, in two series of 3 plots each. The first series, Section A, is cultivated shallow (3-4 inches) with country implements; while Section B, is worked deeper (7-8 inches) with English implements. This ensures a deeper application of the limestone on Section B the chief objects being to elucidate the effects of incorporating lime with the soil to different depths, and to test the value of deep *versus* shallow cultivation.

The first application of ground limestone was made in 1913, and repeated in 1919, as follows :—

Sections A and B	Plot 1—15 maunds limestone per acre.
	„ 2—Nil.
	„ 3—30 maunds limestone per acre.

For further details and previous cropping results, past reports may be consulted.

The cropping this year was cowpea green-manure in the rains, followed by oats in the cold weather. Cowpeas were sown on 9th May and ploughed in 12th August. At the time of ploughing there was little to choose between the crop on all the limed plots; they appeared all equally good. The crop on the unlimed plot of Section B was nearly as good as that on the limed plots, but that on the unlimed plot of Section A was a very inferior crop.

Oats germinated well over but died off on the unlimed plots completely. Again, as in previous years, the limed plots of the shallow cultivated Section A led the corresponding plots of Section

B from the start. The crops on Section A were darker in colour, stronger and finished up better. Unfortunately the exceptional rain in February and March not only delayed ripening, but battered the crop so badly that the greater portion of the grain was shed on the plots.

The crops were thus not worth weighing; the results would have been valueless and not comparative. From field observations I place the relative order as follows:—

Section A—Plot 3—First.

„ B— „ 3—Second.

„ A— „ 1—Third.

„ B— „ 1—Fourth.

Taking the results of this experiment to date the evidence is overwhelming that for most ordinary farm crops, be they deep or shallow rooted, it pays not to incorporate the lime too deeply, at any rate on our soil.

Again the cowpea crop, which is so far the only one to make any crop on the unlimed plots, undoubtedly pays in the absence of lime for deeper cultivation.

The resistance of crops to soil acidity in the seedling stage appears to be a much more potent factor in deciding whether a lime application shall be applied deep or shallow than rooting habit.

15. Block K—Experiment to study the functions of lime.—This experiment was started in 1912, the present being its 8th year. It was originally laid down to study the early function of lime on our sour soil, and the earlier results described in Memoir No. 9, Volume III, Chemical series of the memoirs of the Department of Agriculture in India entitled "Studies of an acid soil in Assam" have subsequently been confirmed year by year. This year the various plots were again manured with their respective artificial manures and mixtures thereof, both on the limed and unlimed sections.

The limed sections were given a dressing of ground limestone at the rate of 30 maunds per acre, having had no lime since 1912.

Cowpeas were taken as the rains crop followed by oats in the cold weather. The general indications given by these two crops are qualitatively the same in regard to the value of the various basic and other manures used; however in the cold weather lime

and the various basic manures show up to much more effect on the oats, while in the rains the effect of phosphatic manures appears to greater advantage on the cowpeas. The results which continue to come out strongly year by year are the positive value of basic manures, e.g., lime, etc., followed by the beneficial effect of phosphoric acid, more particularly in its basic forms; the harmful effect of the continued use of sulphate of ammonia without lime, and the failure of certain artificial manures, e.g., the commercial nitrates and potash salts and superphosphates, applied singly or in mixtures year by year, to produce a cold weather crop of oats in the absence of lime on our soils.

With lapse of time those plots which get heavy dressings of cowdung but no lime are producing heavier and heavier crops, though when the land was first broken up this was not the case. Thus continued cultivation and the use of organic manures would seem to have a great ameliorating effect on the sour soils, even in the absence of lime.

As between the various forms of lime, ground limestone continues to prove itself very effective; if ground very fine it is apparently almost as quick in action as slackened lime; it is slower in action but more lasting if applied somewhat coarser. That the effect of lime on these soils is not due to any special demand of the crops for lime as a plant food continues to be clear in that the same effect is still produced by other bases, e.g., the carbonates of soda, potash and magnesia, etc., and the fact that lime applied as gypsum, i.e., sulphate of lime even in very large doses has no effect on crop production, even now.

16. Mineral Phosphate Experiments in the Sugarcane rotation, Blocks A, B, D and E.—An area of about 1 acre in each of the four cane blocks, has been dressed with flour phosphate with a view to observing its effect on the various crops in the rotation. The phosphate is applied in the 4th year of the rotation previous to sowing the green crop of cowpeas. It will be repeated every fourth year at the same point in the rotation, which is as follows:—

Cane in the first and 2nd year; a green crop of dhaincha followed by oats in the 3rd year; a green crop of cowpeas followed by a catch crop of rape ploughed in in the 4th year.

It is intended to work through two or preferably three rotations on each block before attempting to generalise.

The first rotation has now been completed on all four blocks. The results for this first complete rotation in Blocks A, B and E appeared in previous reports.

On Block D during the first and second years of the rotation there was an average decrease on the phosphate area, for the two crops of cane of 4.1 tons stripped cane per acre. This we think was due to a bad outbreak of disease, "Melanconium Sacchari," which originated in a new variety J 247 planted in the middle of the phosphated area, and which led to much loss of cane there.

In the third year of the rotation on Block D phosphate area the crop of oats appeared to be clearly a better one than on the neighbouring unphosphated area. Unfortunately the crop was largely destroyed by the heavy and continuous rain in March, and the results are valueless.

Basing one's remarks on the results obtained in the first completed rotation on all four cane blocks in regard to the value of this mineral phosphate one would say that in regard to the cane crop its action was still inconclusive, but very positive in the case of the rape crop and also well marked in the case of oats and green crops. It is quite possible that the other manure regularly supplied to the two cane crops in the rotation carries with it sufficient phosphoric acid to meet all demands of the cane for this element of plant food.

In paragraphs 7 and 8 of this report will be found an account of the effect of the phosphate on the ratoon and plant cane crops in the year under report.

Block A was the area to receive phosphate this year; this is its second application, the first having been given in 1915. The crop of rape following in the cold weather was infinitely better on the phosphated area.

17. Pulse crops.—In continuation of the previous year's work, a number of pulse crops were again grown. Last year it was found that September sowings did much better than if sown in October. This has been confirmed again this year; the earlier sowings make much greater vegetative growth and ripen their crop off earlier. If sown too late the early spring rains frequently cause the ripening crops to rot.

The results are shown below :—

Variety.	Date of sowing.	Calculated output per acre.	Remarks.
1	2	3	4
1. "Rangoon or Burma Bean."	(a) 22nd Aug. 1919	Seed. lbs. 1,320	
"Pebyugale" ...	(b) 4th Sep. 1919	650	(a) and (b) Sowings had not quite finished; seeding by 31st March.
(Phaseolus lunatus) ...	(c) 22nd , ,	Small crop	(c) Did very poorly; crops still ripening off.
2. Kulthi Kalai (Dolichos biflorus).	22nd , ,	500	
3. Rice bean or Rumbaija (Phaseolus Calcaratus).	22nd , ,	320	Both those would probably have done better with earlier sowing.
4. Matikulai ...	22nd , ,	740	
5. Rice bean (climbing variety).	18th Oct. 1919	...	Crop still flowering, due to late sowing.

It will be seen that the earliest sowing of the Rangoon bean did very well. This is a crop probably well suited to garden cultivation by cultivators, but on a field scale I doubt whether it would do much good in their hands.

A pulse crop which appears likely to meet cultivators' conditions, "Para Pea," a small-seeded variety of the cowpea, was tried for the first time and cropped excellently. It is useful both as a green crop in the rains, and as a pulse crop later in the season. In the West Indies it is grown as a good crop and highly esteemed as such. It will be grown on a field scale in 1920.

18. *Fodder grasses.*—The experiments with Guinea grass and Rhodes grass were continued. During the rains the alternate rows of grass from the plots in Block A described in the last year's report were removed for transplantation elsewhere leaving the crop 4 feet apart between rows and 2 feet apart in the row. Both cropped well, throughout the season, being manured in trenches between the rows with cowdung once early in the rainy season.

Again as last year, Rhodes grass proved the heavier cropper during the cold season December to end March.

Details of cuttings are given below:—

Details of Cuttings.

1	2	Area of plot.	Outturn. April 1st to November 30th, 1919.	Outturn. December 1st, 1919, to March 31st, 1920.	Total outturn per plot.	Calculated total outturn per acre.
		Sq. ft.	Mds. srs.	Mds. srs.	Mds. srs.	Tons.
Rhodes grass	3,240	36 4	10 10½	46 14½	22.8
Guinea grass	3,600	56 17	6 33½	63 10½	28.0

During the rains a further area of both grasses was planted out under field conditions in Block M, i.e., 0.25 acre of Guinea grass and 0.16 acre Rhodes grass. The Guinea grass established itself much more readily than the other, and yielded up to 31st March a total crop of 10½ tons green fodder per acre.

The Rhodes grass was very slow in getting hold and only cut rather more than 1 ton green fodder up to the end of the year. This grass needs much more care to get it established than Guinea grass.

A new importation "Sudan grass" from Australia was grown from seed during the year. This grass is reported from Australia to be very palatable and, to be superior to most of the grasses in nutritive ratio. It grew well here throughout the rains and seeded freely. After seeding the stools were cut down and transplanted in the grass area, when they have established themselves. Further work on this is necessary.

19. *Extension Area—Block M.*—This was planted up with selected canes of several varieties for use as planting material. On the limed area all varieties made excellent growth and averaged 30—35 tons cane per acre. On the unlimed area germination and subsequent growth and development were by comparison much retarded and the crops finally averaged 10—15 tons per acre; the difference due merely to the application of 30 maunds of ground limestone some 5 years ago to the western area, was extraordinary. The two areas have otherwise been regularly similarly cropped and manured for the past five years,

and the great increase in crop from the western area can only be due to the initial limestone application. This agrees with our experience during the past 10 years on all the other cane areas on the farm.

Blocks O, N, P.—Block O was half under ratoon cane for distribution; the rest was green manured with dhaincha in the rains, and was sown with Burma bean on 20th October. This was far too late to sow it judging from our previous experiments, but the late Autumn rains prevented earlier preparation of the land and sowing. As a result the crop did very little good and was so late ripening off its small crop of seed that it had had to be ploughed in, as this area was needed early in March for sugar-cane planting.

Blocks N and P were under green manures in the rains and *matikalai* in the *rabi* season. The *matikalai* was also late sown on account of the wet season and did little good in consequence.

Block R.—In 1918 an experiment in the use of Water Hyacinth ashes was commenced here. Two plots $\frac{1}{4}$ acre each were laid out. One plot received Hyacinth ashes at the rate of 20 maunds per acre in May 1918. The Northern half of either plot, i.e., $\frac{1}{8}$ acre in each case, was cross dressed with Basic slag of poor quality at 5 maunds per acre. No other manure has been applied. Soybeans were sown early in June 1919, and harvested in December.

Outturns were	Grain.	
	lbs. per acre.	
	16 lbs.	
{ No manure at all	...	
Basic slag alone	25 ,,	
Basic slag and Hyacinth ashes	150 ,,	
Hyacinth ashes alone	125 ,,	

The yields are extremely poor, but the soil is newly broken up and very unfertile naturally until limed and well manured. The results nevertheless show that Hyacinth ashes have some value as an ameliorant on sour soils, but they would have to be used in large quantities to do much real good. The ashes contained 8.94 per cent. potash, but they probably function in our case as a neutraliser of soil acidity chiefly, in the same manner as ordinary wood ashes do in our experience.

20. *Other crops.*—Block D was under dhaincha as green manure after two years of cane. The phosphated area carried a distinctly better crop than the remainder of the area. In the *rabi* season, oats followed dhaincha on Block D. The season was a good one for growth and the crop was a good one and promised well until the early heavy and continued rains came, which completely laid and ruined it, much of the grain rotting.

Block H—was green manured in the rains, and sown with cowpea "Jorhat Brown" for seed in August. This made a fine crop, giving well over 8 maunds seed per acre.

21. *Entomological work on the Farm*.—The Entomological Assistant was headquartered at the Farm during the year and was thus better able to exercise some control over farm pests.

The campaign against cane-borer was continued and by regular removal of affected canes in the early stages, the crop was undoubtedly much freer from bored canes at harvest time.

Rats again appeared in the cane areas at ripening time and did much damage. Extermination by fumigation was tried, and later poison baits were used. Both these measures had only a temporary effect.

Work against the mealy bug of cane, various pests of fruit trees, crickets, and hairy caterpillars, and the mustard saw fly was taken up with varying success, and the farm seeds were fumigated previous to storage.

22. *Orchard*.—The fruit trees comprise 16 lichis, 6 mangoes, 1 custard apple, 1 peach, 3 sapota, 4 guava, 1 pomelo, 12 oranges and 1 plum.

All fruited well except the young oranges, the peach and the mangoes. The latter set their fruit but they all dropped before ripening. There are four varieties of pineapples—Ceylon, Kew-giant, Queen and Spanish; all fruited well and there was a large demand for fruits and suckers.

The lichi trees were badly attacked by a mite; the trees were pruned and the affected branches cut off and burnt.

23. *Receipts and Expenditure*.—The receipts for the year ending 31st March 1920, were Rs. 3,570-12-3, the total expenditure being Rs. 11,059-7-9, inclusive of Rs. 3,741-5-7 on account of establishment charges.

24. *Establishment*.—This consists of a Manager on Rs. 100—10—200, a clerk on Rs. 25—1/8—40 and a peon on Rs. 8. The number of apprentices on the farm at the beginning of the year was seven. Two completed their training during the year and two resigned. Five new apprentices were admitted for training. One resigned. At the end of the year there were six apprentices on the farm.

An Assistant Farm Manager is badly needed here for the timely and proper conduct of the various experimental work in hand.

25. *Inspection, etc.*—The Hon'ble the Chief Commissioner visited the Farm once during the year, and the Director of Land Records and Agriculture three times.

During January 1920, the Indian Sugar Committee also inspected the Farm.

In March a large gathering of local cultivators was entertained, and the various experiments and work in progress were shown and explained to them.

A. A. MEGGITT,
Agricultural Chemist to the Assam Administration.

REPORT OF THE UPPER SHILLONG AGRICULTURAL
EXPERIMENT STATION FOR THE YEAR ENDING
THE 31st MARCH 1920.

1. The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunjee road, $5\frac{1}{2}$ miles from the town of Shillong, and occupies the site of the old Model Farm which used to exist in 1879. The elevation of the place is 5,900 feet, about 900 feet higher than Shillong town. The total area of the farm is 366.67 acres of which a large portion is occupied by pine forest. Most of the cultivated and culturable land lies along narrow valley. The bottom of the valley was formerly marsh which was of very little value for any purpose; it has recently been converted into firm pasture ground by deepening a stream which drains the valley and opening side drains into it. The effect of this work is now showing in the considerably improved herbage which is produced.

The soil of the higher lands is a coarse reddish loam of very loose texture which can be worked with great ease. The subsoil of a pronounced reddish colour and of great depth. In a small portion of the cultivated area the soil is black owing, it is believed, to the existence of some mineral compound. At the bottom of the valley a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having been under a thick growth of grass, the upper portion of this soil is a matted mass of half decayed grass-roots.

The soil of the farm is extremely poor and very little can be grown on it without the help of manure.

The greater part of the station suffers from the disadvantages of an exposed situation. The place is colder and more windy than Shillong; frosts are of very common occurrence and are more severe than in the town. During the winter the growth of vegetation is entirely suspended.

2. The main objects for which the station is maintained are
 Purposes of the station (1) the trial and introduction of new varieties of potatoes which are the most important among the crops grown on the plateau of the Noh Hills, (2) the breeding of improved strains of milch cattle suitable for this tract and the cultivation of fodder crops for their keep. Fodder experiments have been tried from time to time, but having proved abortive, they have one after another

dropped out of the programme of the farm. Very little experimental work beyond the potato trials is done at present on the farm, and if we leave out the cattle and the fodder crops grown for them, the station may be looked upon more as a seed-growing farm than one devoted to experimental work.

Weather. 3. The following table gives the rainfall for the period under report:—

Rainfall.

	1	Actual, 1919-20.	Normal.	Number of rainy days, 1919-20.
	2	3	4	
April	6.85	4.48
May	9.83	8.83
June	14.63	20.04
July	7.13	17.75
August	7.77	15.67
September	16.23	11.06
October	4.86	7.55
November	1.54	1.27
December	0.06	0.18
January	0.00	0.29
February	1.04	1.02
March	3.29	2.25
Total	...	72.73	90.89	132

Statement showing the average yield per acre on duplicate plots for the last 12 years.

Variety.	Average yield per acre on duplicate plots for the last 12 years.												Remarks.		
	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. King of Potatoes	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
2. Magnum Bonum (1908)	4.81	5.94	4.97	9.20	6.35	8.0	6.54	8.58	7.37	4.82	3.61	11.7	6.83		
3. King Edward VII	4.70	4.51	5.23	9.25	6.77	7.85	6.07	8.15	6.90	4.88	3.22	10.18	6.43		
4. Khasi Nainital	6.18	2.75	3.46	7.35	4.61	6.17	4.90	4.68	6.10	2.68	3.21	9.87	6.01		
5. Khatai Round	6.68	3.64	4.13	8.71	6.43	6.93	6.30	6.11	5.78	4.36	4.10	10.7	6.08		
6. British Queen (1909)	4.76	2.27	2.89	6.83	4.95	4.52	4.51	4.09	4.95	3.40	3.78	9.35	4.81		
7. Up-to-Date	6.29	3.22	4.75	9.12	7.36	7.19	6.60	6.66	6.06	3.40	...	...	6.06		
8. Magnum Bonum (1912)	6.07	3.33	4.05	8.91	4.95	6.24	5.72	5.23	...	...	...	...	6.16		
9. Windsor Castle (")	7.45	4.27	6.48	10.12	6.20	8.75	6.73	7.19	...	...	...	...	6.90		
10. British Queen (")	6.10	3.01	5.0	7.05	6.10	6.08	5.23	2.68	...	...	...	...	6.35		
11. Fleur d'Ally	6.48	3.79	3.05	4.54	5.23	6.3	6.55	...	...	...	...	...	6.78		

Three new varieties were planted last year and enough seeds have been obtained to include them in the variety trial during the coming season.

Twenty lots of seed were obtained in February 1916 from St. Andrew's University, through the kindness of Donald Ferguson, Esq., of Dhamai Tea Estate, Sylhet, Honorary Correspondent of the Department. Half of each lot of seed was sown in boxes on 20th February 1916, and the remaining half was sown similarly on the 19th March 1916. Out of twenty lots, numbers four and twenty failed to germinate. The others grew satisfactorily, and the seedlings were planted in the field on the 15th May 1916.

Two lots of seed produced only one plant each, and as one of these plants failed to form any tubers, the total number was reduced to seventeen. These have given widely varying yields in the past seasons. Enough potatoes have, however, now been produced to test them on a field scale during the current year.

Mr. G. B. Hinde of Kamrup obtained 18 lots of potatoes from England and kindly gave them to the Shillong farm for trial. They were obtained very late and planted in May. They all germinated and a few tubers were obtained from each plot. Half of these were sent to Mr. Hinde and the rest have been planted on the farm. It is hoped that enough tubers will be obtained to include them in the trial experiment next year.

As in former years 50 tubers of each variety were selected at random, and examined for signs of disease. The following table gives the result of the examination in the last ten years:—

Varieties.	Number of diseased tubers out of 50 examined.									
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.
1	2	3	4	5	6	7	8	9	10	11
King of Potatoes ...	12	nil.	nil.	nil.	1	5	3	nil.	2	7
Magnum Bonum (1908) ...	6	4	2	4	2	nil.	1	nil.	4	6
King Edward VII (1906) ...	13	8	4	6	5	4	1	nil.	1	17
Khasi Nainital (1909) ...	48	16	8	4	4	8	nil.	1	6	8
Khasi Round (1906) ...	4	8	6	10	6	6	10	3	7	1
British Queen (1909) ...	12	...	6	4	2	8	2	...	1	9
Up-to-Date (1908) ...	4	32	16	4	1	6	4	1	...	8
Magnum Bonum (1912) ...	...	...	6	6	2	2	1	5	1	1
Winton Castle (1912) ...	...	...	4	3	2	10	1	...	...	4
British Queen (1912) ...	...	...	4	4	3	6	1	1	5	4

Varieties.	Number of diseased tubers out of 50 examined.									
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.
1	3	3	4	5	6	7	8	9	10	11
Flour Ball (1912)	6	5	1	10	1	1	1
Imperial (1912)	22	3	3	4	6	...	2
Gilding Castle (1916)	10	...	5
Epicure (1915)	5	1	6
Liqueur Bonum (1915)	6	...	3
Ever Castle (1915)	4	1	4
Up-to-Date (1916)	1	1	1
King of Potatoes (1916)	3
Empress Castle (1915)	2	3	1
Edinburgh Castle (1915)	3	...	3
Aquilibrium	3	...	9
Embossed Castle	5	3	7
Janet Chief	2	2	2

Potato manuriel experiment.—An experiment designed to test some light on the respective manuriel values of rape cake and bonemeal for the potato crop is being carried out since 1916. This experiment was put down in duplicates in two series, one with King of Potatoes and the other with Magnum Bonum. The seed rate was 98½ pounds per acre. The manures used and the yields obtained in 1919 are shown in the accompanying table:—

1	2	3	4	5	6	7	8	9
Manure used per acre.	Cow-dung 5½ tons. Rape cake 623 lb.	Cowdung 5½ tons, Rape cake 623 pounds.	Rape cake 623 pounds.	Bonemeal 623 pounds.	Cowdung 5½ tons, bonemeal 623 lb.	Rape cake 623 lb., bonemeal 623 lb.	Lime 1½ tons.	Cowdung 5½ tons, lime 1½ tons.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
King of Potatoes ...	2.97	2.93	1.64	1.60	1.52	2.37	1.73	1.92
Magnum Bonum ...	2.69	3.70	1.46	1.48	2.38	2.05	.35	2.78
Total ...	5.06	6.63	3.10	2.88	3.90	4.42	2.09	4.70
Average yield per acre ...	2.53	3.31	1.65	1.44	1.95	2.21	1.04	2.35

Bonemeal and rape cake were used not because they were considered the most suitable for the potato crop but because they are practically the only manures other than cowdung which are available in Khasi Hills. The experiment is being repeated during the present year with slight modification.

6. It is the custom among the Khasi cultivators to grow an autumn crop of potatoes, principally for the purpose of using the produce for seed for the following spring crop. This custom has been followed at the farm for some years, but owing to the exposed situation of the farm it has been found that the yield of the autumn grown crop is so small as to make seed produced in this way extremely expensive. With the object of finding a cheaper source of seed the method of boxing summer sets was tried. The method consists of placing the seed potatoes in shallow boxes specially made for the purpose and of storing them in a well lighted but not too airy shed. Under conditions of moderate temperature and moisture the sets keep satisfactorily and produce short well-formed sprouts, which grow at a slow rate. These sets can be planted out from the boxes at the ordinary planting season and are then likely to grow rapidly.

During 1918 and 1919 potatoes from the summer crop were placed in sprouting boxes and kept there during the subsequent cold weather. In the spring these sprouted summer sets were planted along side unsprouted winter sets. The size of sets and weights used per acre were approximately the same. Similar conditions of cultivation, manuring and spraying were observed for both plots and as the experiment was tried with six of the main varieties, the results may be taken as fairly conclusive.

The average of the yields obtained were as follows :—

		Sprouted.	Unsprouted.
1918	...	4.45	4.41
1919	...	7.26	5.53

The results obtained so far are satisfactory and if confirmed in future years would be capable of profitable expansion, both on the Farm and outside. The experiment is being continued during the present year, and a careful record will be kept of the proportion of wastage of the summer seed during storage.

7. The six varieties of potatoes which have given the best results so far were grown during 1919 for the production of seed. The crop was planted in March and harvested in August. The total area planted was 4.45 acres.

The manures used were, as in previous years, 5·5 tons of cowdung and 823 pounds of rape cake per acre. The crop was sprayed once with Bordeaux mixture at the rate of 120 gallons per acre. The outturn was as follows:—

Variety.	1	Area in acres.	Total yield, in tons.	
			2	3
King of Potatoes	1·45	3·4
Magnum Bonum	1·4	4·85
Up-to-Date	·4	·88
Windsor Castle	·4	·97
British Queen (1919)	·3	·8
Imperator	·5	2·5
Total	4·45	13·85

The average yield amounted to a little over 3 tons per acre against 2·11 tons in 1918.

During the present year about 10 acres have been planted in March with the same 6 varieties. The demand from the plains for seed potatoes grown in the Shillong Farm is extending rapidly. In order to meet this increased demand the area under this crop has been extended as far as practicable with the quantity of cattle manure which is available. Even then there is an insufficient supply for the requirements of both hills and plains districts. To still further increase the supply, arrangements were made in 1916 to cultivate an extra area of potatoes under the *jhum* system and this has been continued since. In that year an area of $16\frac{1}{2}$ acres was planted on the Farm lands according to this system, in 1917 $10\frac{1}{2}$, in 1918 $10\frac{1}{2}$, in 1919 6 acres and during the present year 5 acres.

An agreement was made with Khasi cultivators that the Farm should provide the land and the seed, and the cultivators should do the work and return to the Farm one and a half time the seed supplied. The cultivators also undertake to sell at bazar rates whatever additional quantity of seed may be required. The policy has been to gradually reduce the area. This system will be discontinued from next year. In 1919 the Farm supplied 1·76 tons and received back 2·79 tons. In addition 4·43 tons were purchased according to the bazar rate for distribution in the plains. 2·55 tons have been supplied during the present season.

The total quantity of potatoes available for disposal in 1919 was 25.62 tons made up as follows :—

	Tons.
Farm grown	... 22.83
Seed returned by <i>jhum</i> growers	... 2.79
	<hr/>
	25.62
	<hr/>

This was disposed of as follows :—

Sold to cultivators	... ...	5.82
Used on the Farm	... ...	11.58
Dryage and rottage	... ...	8.24 (including the quantity fed to cattle)
Total	... ...	<hr/>25.62

There was very heavy rottage in the potato during the year on the Farm as well as outside. This was due to the climatic conditions as already explained. The poor outturn is also due partly to the rottage of potatoes in the ground before they were harvested.

8. Attempts were made to grow Naga Hill rices and to carry out bonemeal and liming experiments on wet land paddy. with wet land paddy, but without any success, as the paddy could not be got to ripen before winter set in.

9. *Buckwheat*.—This crop has been recently introduced into the district by Nepalese settlers, and although the returns have not been very large, it seems to have possibilities on the Khasi Hills, as the cost of cultivation is so small. When the seed is sown immediately after the potato crop is dug, no extra cultivation is required. On the Farm this course was followed satisfactorily for the first two years of the experiment. In subsequent years the crop has been disappointing owing to early frosts.

In August 1919, three acres of potato land was sown but owing to heavy downpour of rain in September, the crop was damaged and only a few plants remained here and there.

Rhubarb.—This crop was first planted in 1912 on a plot of about $\frac{1}{10}$ th of an acre. Two additional plots have been planted since— $\frac{1}{10}$ th acre in 1915 and $\frac{1}{3}$ rd acre in 1918. The land was manured with cowdung at the rate of 11 and lime 36 ton per acre. During the year under report about 290 pounds of stalks were sold realizing Rs. 36.4.0. The plants are growing well.

Strawberries.—In September 1916 an additional plot of $\frac{1}{50}$ th acre was planted with two varieties of strawberries obtained from the Fruit Experiment Station, Shillong. These plants grew well and in October 1917 another $\frac{1}{10}$ th of an acre was planted with the suckers of these two varieties. With the plot planted in 1912 the total area at present is about .17 acre.

Other fruits.—A few of the trees on the Farm bore fruits. These were sold and realized the following sums:—

			Rs. a. p.
Apples	...	...	21 5 3
Peaches	...	...	1 7 3
Chestnut	...	...	23 10 9

Fodder crops. 10. The following fodder crops were grown during the year :—

Name of crops.	Area sown.	Cost of cultivation.	Outturn of green fodder.
			1 2 3 4
		Acres.	Rs. a. p.
Maize	10.25	348 13 7
Maize/jhum area	...	3 Approx.	...
tasses	10.97
Total	13.25	348 13 7
			Tons.
			31.16

The maize crop gave a very poor yield.

The whole of this fodder (31.16 tons) was made into ensilage. From this quantity of green material 18.49 tons or 60 per cent. was recovered as ensilage of good quality.

The total cost of silage was Rs. 46.3-5-4, made up of:—cost of cultivation Rs 348-13-7, and cost of carrying the fodder, chopping, and packing in the silo Rs. 11.7-7-9.

The proportion of loss through decay around the sides of the pit in which the ensilage was made was somewhat higher than that of the previous year. The rotage was due mainly to grass (ensiled for trial). The cost per ton of silage was Rs. 25.3-6 as compared with Rs. 25.10-0 in the previous year.

Raishan (*Paspalum Sanguinale*)—has been successfully grown as a hay crop since 1912 and has proved a valuable winter food for the cattle. Raishan was grown on an area of 50·1 acres and the produce was made into hay and fed to the cattle during the winter months.

A total amount of about 36·70 tons of hay was fed during the year and '81 ton sold. The cost was Rs. 1,120-7-7 or a little over Rs. 30-8-0 per ton of hay as compared with Rs. 28-14-0 in 1919.

The quality of this fodder was good and eaten greedily by the cattle.

11. An important change was made during the year regarding the policy of cattle breeding to be pursued Cattle breeding. at the Farm. In 1918 one Montgomery and one half-bred Ayrshire bull was introduced. Two Patna bulls were purchased in 1918 and a bull bred at the Farm was also being used. The result was that the progeny had become somewhat promiscuous. In consultation with Mr. Birt it was decided that for the present our aim should be to breed two herds, one of pure Patna and the other with a mixture of Bhutia blood. All attempts at crosses are to be deferred until a definite programme of cattle breeding was decided on.

To carry out the above object a final selection of 30 cows and heifers were made after a rigid weeding out. These have been divided into two lots. The breeds are kept separately and allotted to two bulls.

All crosses and old and weedy animals were sold at a public auction on the 23rd August. Thirty-five animals were sold for Rs. 2,539, Rs. 205 being the highest price obtained for a cow and Rs. 90 for a heifer.

The half Patna cattle and the progeny of their cross with Bhutia breeds have proved remarkably well adapted to the climate of the Khasi Hills. In respect of milking capacities these cattle stand head and shoulders above any cattle in this side of India. The demand for these cattle continues keen but is still practically confined to a few people about Shillong who are experienced in the care of cattle. The breeding bulls are generally in good demand, and are disposed of as fast as they reach the age of three years, when they are considered fit for use. The demand, however, is mostly from tea planters and a few other people from the plains.

Three pure Patna bulls for breeding were sold during the year and there are several applications in our waiting list. The total number of animals sold during the year was :—

Bulls	...	...	...	...	21
Cow	...	...	...	...	12
Heifers	...	...	...	...	23

The following table shows the number of animals at the farm on the 31st March 1920.

Description.	Mohatta.	Montgomery x Ayrshire.	Montgomery x Patna.	Montgomery x Patna x Bhutia.	M x P x B x P.	M x P x B x P x P.	M x Bhutia.	Patna.	Bhutia (B).	P x B.	P x B x P.	P x B x P x P.	P x B x P x P x P.	P x Khasia (K).	Total on 31st March 1920.	Total on 31st March 1919.	Total on 30th June 1918.	Total on 30th June 1877.	Remarks.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Breeding bulls	...	1	...	...	...	...	...	...	2	...	...	...	...	...	...	9	2	1	1	
Bulls (3 years and above).	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	9	3	10	6	3
Bulls (2 to 3 years) ...	...	...	1	...	...	1	...	1	...	...	...	...	...	...	...	3	5	9	7	
" (1 to 2 years) ...	...	...	...	1	...	3	...	...	...	...	...	...	...	...	...	1	8	6	8	
" (under 1 year) ...	...	...	2	2	4	...	...	...	...	...	...	1	1	...	...	10	5	10	6	
Heifers (2 to 3 years)	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	2	5	10	10	
" (above 3 years) ...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	2	0	5	1	
" (1 to 2 years) ...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	4	12	7	12	
" (under 1 year) ...	...	...	2	2	2	...	2	2	...	2	...	2	...	2	...	8	12	14	9	
Cows ...	...	...	...	...	...	...	...	12	...	1	2	3	...	...	25	30	32	20		
Total on 31st March 1920.	1	...	10	8	6	1	...	21	...	1	12	4	...	2	61	...	...	...
Total on 31st March 1919.	2	1	13	5	9	2	2	32	1	7	17	7	1	2	...	98	...	...
Total on 30th June 1918.	2	1	4	4	3	4	1	39	1	9	14	14	3	2	...	...	...	...
Total on 30th June 1877.	1	...	...	...	...	...	...	40	1	0	14	15	4	2	...	...	...	84		

REPORT OF THE FRUIT EXPERIMENT STATION,
SHILLONG, FOR THE YEAR ENDING THE 31st
MARCH 1920.

1. Introductory.—The Fruit Station commenced work in October 1912 : the first trees were planted in 1913. The land is situated on the south side of the Jowai road, distant about a mile from Shillong station, the elevation is about 5,100 feet. The total area of the station is 62·60 acres, of which about 30 acres is suitable for fruit growing : 28 $\frac{3}{4}$ acres have been planted.

2. Lower Garden.—No extension to this block has been made since 1913-14. The planted area is 4 $\frac{1}{4}$ acres in grounds of 6·13 acres : the fruit trees are planted 15'×15' diagonally. The soil of this plantation varies from light sandy loam lying above boulders to heavier loam of good depth. The following varieties of apple trees on the Paradise stock show the best improvements in growth and yield, James Grieve, Kerry Pippin, Bismarck Bramleys Seedling, Yellow Ingesterre, Peasgood Nonesuch, Lady Sudeley, Worcester Pearmain, Barnack Beauty, Sturmer Pippin, Lanes Prince Albert. The following trees have not fruited; Farns Pippin, Rosemary Russet, Newtown Pippin, Coronation, Roundway, Magnum Bonum. Of the other varieties Ribston Pippin flowers profusely but is a small cropper; Mannington Pearmain is a failure, its fruit cracking at an early stage. With the exception of Cox's Orange Pippin, Golden Reinette, Crimson Bramley, Norfolk Beauty, Encore, Newton Wonder, Potts Seedling, and Alfriston, which promise the best, I would not at present recommend planting any of the other varieties, though some of them may yield profitably when they are older. In 1913-14 only a few Standard Apple trees on Crab stock were planted and of these only Rymer and Northern Greening varieties have thrived : both these promise well and as far as can be judged now from growth, yield, and quality of the fruit, the Rymer Apple will be one of the culinary varieties likely to succeed. The appearance of the Northern Greening is against it as a market Apple, but it is a valuable, late sort and pays well for storing : it appears though to be one of the varieties that bears well every other year.

The other standard trees in the garden were planted during the last 2 years and only Rev. W. Wilks and Barnack Beauty have fructed : both these varieties promise well : the others are trees obtained from Kashmir and have not yet fruited. The growth of the Pear trees on Quince stock was poor, and the yield from the few varieties that bore was disappointing. The varieties

Fertility, Louis Bonne of Jersey, and Fondant de Thirriot, did best. The treatment of these trees differs considerably from those on Pear Stock. The fibrous roots near the surface must be encouraged in growth by top dressings, and fresh earth given regularly in the autumn. As the roots are not far from the stem it is necessary to thus nourish the trees, and also to give frequent applications of water from January to April. The trees treated in this way this year show a very marked improvement to the rest. The soil in this garden is not suitable for cherries and several trees have died. The Kentish cherry is the only variety that has yielded, Peregrine, Kestrel, and Duke of York are the best varieties of the Peaches. The English varieties of Plums show no improvement. A Japanese Plum Satsuma "the blood plum" promises to succeed: the growth of the tree is satisfactory and the dark red fleshed fruit is excellent for preserving. The Langley Bullace trees had very little fruit on them this year. The Merryweather Damson trees had a small crop. None of the other varieties fruited. The Giant Himalaya Berry of California and the Blowers are the best of the varieties of Blackberries, and the King Acre Berry the best of the Hybrid Berries. The other varieties kept have been moved to the South-West Block for further trial. The land has been kept in good cultivation during the year. Bone-meal has been applied to the Pear trees and fresh earth to all the trees. Stone terracing round the trees on the slopes has been done. The lighter soil was again found to be infested with Cockchafer grubs necessitating removing the soil around the trees to destroy them. A great many were also killed when the garden was hoed. During May and June the beetles were caught in thousands by lamp light after dark. The pests in the Orchard are receiving the attention of Mr. T. Bainbrigge Fletcher, Imperial Entomologist, Pusa. It is hoped that means will be found to control them.

3. *Upper Garden*.—The area planted is $24\frac{1}{2}$ acres, of which $10\frac{1}{2}$ acres was planted in 1914, 2 acres in 1915, $\frac{1}{2}$ an acre in 1916, $5\frac{1}{4}$ acres in 1917, $2\frac{1}{4}$ acres in 1918, 4 acres in 1919. It is divided into 7 blocks, viz. :—

Top block.—Area $1\frac{3}{4}$ acres, planted in 1914 with Bush Apple trees $15' \times 15'$ diagonally.

North block.—Area $1\frac{1}{2}$ acres, planted in 1914 with Standard Apple trees $34' \times 34'$ diagonally, interplanted with Bush Apple trees $17' \times 17'$.

South block.—Area $5\frac{1}{4}$ acres, planted with Standard Apple trees $30' \times 30'$ diagonally, interplanted with Bush Apple, Pyramid Pear, Cherry and Plum trees $15' \times 15'$, $\frac{3}{4}$ acre planted in 1914, $\frac{1}{4}$ acre in 1915, $\frac{1}{2}$ acre in 1916, $2\frac{3}{4}$ acres in 1917, 1 acre in 1918.

East block.—Area $8\frac{1}{4}$ acres; 7 acres is planted with Standard Apple trees $34' \times 34'$ diagonally, interplanted with Bush Apple trees $17' \times 17'$; $5\frac{1}{4}$ acres planted in 1914, $1\frac{1}{2}$ acres planted in 1915. The remaining $1\frac{1}{4}$ acres was planted in 1918 with Standard Pear trees $25' \times 25'$ diagonally.

South-west block.—Area 4 acres planted in 1919 with Standard Apple trees $30' \times 30'$ diagonally, interplanted with Bush Apple and Plum trees $15' \times 15'$ in 1919 and 1920.

East block extension.—Area $2\frac{1}{2}$ acres, planted in 1917 with Standard Apple trees $30' \times 30'$ diagonally, interplanted with Bush Apple trees $15' \times 15'$.

West block.—Area $1\frac{1}{4}$ acres, planted with Standard Pear trees $25' \times 25'$ diagonally, interplanted with Bush Pear trees $12' 6'' \times 12' 6''$; 1 acre planted in 1914, $\frac{1}{4}$ acre in 1915.

The soil of the Upper Garden is a good loam of about 12 inches depth lying on a red sub-soil. Small plots have a hard pan sub-soil about $2\frac{1}{2}$ feet from the surface. The whole of the planted area has been terraced with stone and banks. This has successfully prevented the denudation of the soil by rainfall.

The following statement shows the varieties of the Apples and Pears grafted: the weakly and the badly grown ones have been up-rooted:—

Varieties and Stock.	North block.	Top block.	East block.	West block.
1	2	3	4	5
APPLES GRAFTED ON CRAB STOCK.				
Bismarck	225	...	68	...
James Grieve	642	...	146	...
Kerry Pippin	74	...	105	...
Lanes Prince Albert ... ... ...	...	...	36	...
Rev. W. Wilks	61	88	12	10
Stirling Castle	76	...	5	...
Red Victoria ... ... ...	...	...	43	...
Crimson Bramleys Seedling ...	...	...	61	...
Bramleys Seedling ... ... ...	...	...	38	...

Varieties and Stock.	North block.	Top block.	East block.	West block.
1	2	3	4	5
APPLES GRAFTED ON CRAB STOCK—concl'd.				
Affriston	129	...
Bens Red	68	...
Rival	93	...
Pomino	102	...
Norfolk Beauty	71	...	...	...
Total ...	1,149	88	885	10
APPLES GRAFTED ON PARADISE STOCK.				
Bismarck	58	...
James Grieve	147	...
Early Pippin	96	...
Rev. W. Wilks	61	...
Devon Queen	21	...
Bramley's Beauty	15	...
Elson's Orange	21	...
Total	419	...
PARS GRAFTED ON PEAR STOCK.				
Fertility	338	
Madame Marillat	31	
Fondante de Thirriot	17	
Bailett	18	
Total	464	
PEARS GRAFTED ON QUINCE STOCK.				
Doyenne du Comice	74	
Madame Treyve	99	
Lois-Bonne of Jersey	41	
Madame Marillat	64	
Fondante de Thirriot	49	
D'Anvers	68	
William bon Chretien	60	
Barlett	148	
Lindau	8	
King Karl	4	
Bowell	15	
Genou	9	
Duchesse	10	
Triumph	9	
Bassock	4	
Total	662	

The following varieties of Apples in this Garden show the most promise : James Grieve, Kerry Pippin, Early Peach, Bismarck Royal Snow, Lanes Prince Albert, Wadhurst Pippin, Ecklinville Pippin, Rev. W. Wilks, Domino, Williams Favourite, Peasgood Nonesuch, Lady Sudely, Bramley's Seedling, Boston Russet, Allington Pippin, Jefferson, Barnack Beauty, Ormead Pearmain, Norfolk Beauty, Upton Pyne, Charles Ross, Rymer, Newton Wonder, Hamblings Seedling, Star of Devon. Few of the other varieties bore fruit. Lord Stradbroke cankers badly and should not be planted. The Mannington Pearmain planted in different parts of this garden suffers similarly to those grown in the lower Garden. The most promising of the Standard trees on crab stock are :—Encore, Bramleys Seedling, Newton Wonder, Beauty of Kent, James Grieve, Cox's Pomona, Norfolk Beauty, Rev. W. Wilks, Barnack Beauty, Star of Devon. There are other varieties that have grown well but have not yet borne fruit. The American and Kashmir trees have not yet fruited but are growing well, and good four years old trees have been distributed to Khasis and others. The South-west block was interplanted with Bush Apple trees. Fifty Lanes Prince Albert Apples were picked and stored in August 1919 and kept sound from January to end of March 1920. The growth of the Pear trees on Quince stock was no better than the Lower Garden. Fertility was the only variety that bore more than a fruit or two. The trees have been given fresh earth, which will benefit them. The Standard trees on Pear stock are growing well, but have not borne fruit yet, with exception of a tree of Louise Bonne of Jersey the fruit of which was excellent. None of the English Plums bore fruit, but put on a better growth this year than before. Three varieties of Japanese plums Satsuma—Botan—Burbank have grown well, and the branches have a lot of fruit spurs on them. The American plums flowered profusely but did not set. The Cherry trees in the South block have grown well and the soil there is probably suitable for them.

The Hill Almond trees flowered profusely but the crop was poor. The Strawberry crop was poor. New beds have been made in the south-west block.

Pruning commenced 27th November and was finished at the end of February. During the year Methylated spirit was used against the attack of the Woolly Apple Aphis commonly known as American blight. During the cold weather months all branches and shoots of the trees attacked were cut off and burnt on the spot by coolies following behind the pruners, and where suspected the roots were opened out and the parts attacked cut off and

burnt. It is a very injurious disease and yet at the same time is open to remedy. The presence of this Apple bark plant louse may be easily detected by the cottony growth on the insects giving the appearance of a white film. When there are many, it appears as if a knot of cotton wool were sticking to the bough or even hanging loose. Methylated Spirit, and anything oily, greasy or sticky well rubbed on and which by adhering for a time will choke the Aphides that it touches, is the remedy. It is said that tobacco solution will stop the attack of the roots and this will be given a trial. The attack of small black weevils did a lot of damage to the foliage of Apple and Pear trees during May and June—hundreds of thousands were caught by hand and destroyed but spraying with some poison such as Arsenate of Lead and Caustic applications will have to be done. Some varieties were attacked worse than others and the James Grieve trees fared very badly and in consequence made little growth later. This must affect the cropping powers of the trees and the outlook for a good crop this year from the trees attacked is not favourable. The following standard trees were sent to the Government Farm, Nitarhat, for trial—2 Fertility and 2 Keiffer Pear trees—3 James Grieve, 3 Kerry Pippin, 2 Delicious, 2 Black Ben, Standard Apple trees—6 Blower and 6 Giant Californian Himalaya Blackberry Canes. The following Standard trees were also distributed and planted in January and February :—

Mr. F. A. Toogood's garden, Shillong.—One each of the following Standard Apple trees :—Baldwin, Reinette du Canada, Api Petit, Calville rouge d' hiver, Delicious, King David.

Mr. J. W. Tweedie's garden, Shillong.—One each of the following Standard Apple trees :—Fenouillet Gris, Precoce David, Api Petit, Calville St. Saumur, Calville rouge d' hiver, Reinette de Cuzy, Kashmir Amroo.

Mr. M. M Hadow's garden, Upper Shillong.—One each of the following Standard Apple trees :—Baldwin, Calville rouge d' hiver, Api Petit, Reinette du Canada, Delicious, King David.

Rev. E. H. Williams' garden, Mawphlang.—One each of the following Standard Apple trees :—Rev. W. Wilks, Delicious, King David.

Rev. O Thomas' garden, Mawkhari.—One each of the following Standard Apple trees :—Baldwin, Reinette du Canada, Api Petit, Delicious, King David.

Kpa Ka Ilak's garden, Lairlyngkrt.—Three Keiffer Standard Pear trees, and one each of the following Standard Apple trees:—Calville St. Saumur, Baldwin, Fenouillet Gris, Kashmir Amroo, Delicious, King David.

Dák bungalow Chaukidar's garden, Laillyngkot.—Three Keiffer Standard Pear trees and one each of the following Standard Apple trees:—Fenouillet Gris, Kashmir Amroo, Calville St. Saumur, Calville rouge d'hiver, Delicious, King Dav'd.

U Kumar's garden, Mawryngkneng.—Three Keiffer Standard Pear trees and one each of the following Standard Apple trees:—Reinette de Cuzy, Calville rouge d'hi'er, Fenouillet Gris, Kashmir Amroo, Delicious, King David.

Kpa U Malam's garden, Nongbah.—Three Keiffer Standard Pear trees and one each of the following Standard Apple trees:—Calville St. Saumur, Calville rouge d'hiver, Baldwin, Preeoce David, Fenouillet Gris, Delicious, King David.

Kpa U Sid'n's garden, Mawphlang.—Three Keiffer Standard Pear trees and one each of the following Standard Apple trees:—Reinette de Cuzy, Calville rouge d'hiver, Baldwin, Kashmir Amroo, Fenouillet Gris, Api Petit, Delicious, King David.

Kubur Sing's garden, Mylliem.—Three Keiffer Standard Pear trees and one each of the following Standard Apple trees:—Reinette de Cuzy, Calville rouge d'hiver, Baldwin, Delicious, King David.

Mr. Reid's garden, Upper Shillong.—One each of the following Standard Apple trees:—Baldwin, Calville rouge d'hiver, Kashmir Amroo, Api Petit, Delicious, King David.

The following trees are in Nurseries for future planting:—

Description.	South Block.	East Block.	South-West Block.	Total.
1	2	3	4	5
Standard Apple Trees	...	51	123	120
Standard Pear Trees	...	2	...	37

The establishment consists of an Overseer, and a part time Clerk each on a monthly salary of Rs. 25, and 10 Khasi Nalis on a monthly salary of Rs. 13 each. All have worked well and take great interest in their work.

4. *Varieties planted* — The following statement shows the number and varieties of fruit trees planted :—

Species of fruit trees.	Variety.	Planted 1913-20.								Total number.	Description.		
		Upper garden.				Lower garden.	South-west block.						
		Top block.	South block.	East block.	North block.								
1	2	3	4	5	6	7	8	9	10	11			
Apple trees	James Grieve	59	76	142	58	...	44	...	379				
	Boston Russet	...	2	12	...	...	...	...	...	14	
	Bens Red	...	...	10	10	...	9	...	...	29	
	Alfriston	...	...	29	...	...	8	...	...	37	
	Egremont Russet	10	...	...	8	1	...	...	...	19	
	Annie Elizabeth	...	...	20	...	...	...	...	...	20	
	Caygate Pearmain	7	...	...	10	...	...	...	...	17	
	Lord Hindlip	...	...	10	...	...	...	...	...	10	
	Mamington Pearmain	6	...	...	8	2	4	...	...	20	
	Winter Queening of Kent.	...	...	10	...	...	...	...	...	10	
	Pineapple Russet	...	...	...	9	...	...	...	...	9	
	Edward VII	...	...	8	...	...	...	...	...	8	
	Red Junestling	6	...	1	2	...	10	...	...	13	Bush.
	Flower of Kent	...	...	8	...	...	...	...	...	8	
	Cornish Pine	...	8	...	...	...	...	...	...	8	
	Tower of Glamis	...	...	...	...	...	6	...	...	6	
	Winter Banana	...	...	...	...	...	3	...	...	3	
	Wolf River	...	...	...	...	...	3	...	...	3	
	Chelmsford Wonder	...	...	...	...	...	6	...	...	6	
	Byford Wonder	...	...	...	...	...	10	...	...	10	
	Ruddy	...	...	...	...	...	5	...	...	5	
	Ormead Pearmain	...	...	...	...	...	6	...	...	6	
	Hambledon deux ans	...	...	...	...	...	4	...	...	4	
	Bollede Pontoise	...	...	...	...	...	5	...	...	5	
	Barnack Beauty	...	...	...	...	6	8	5	...	19	

Species of fruit trees.	Variety,	Planted 1913-20.									Total number	Description		
		Upper garden.					East extension.	Lower garden.	South-west block.					
		Top block.	South block.	East block.	North block.									
1	2	3	4	5	6	7	8	9	10	11				
Apple trees	Coronation	4	...	...	6	4	...	5	...	15		
	Wealthy	...	...	...	4	...	6	...	10			
	Feltham Beauty	...	...	10	...	...	...	...	10			
	Norfolk Beauty	8	33	...	10	...	9	10	70					
	Sanspareil	...	3	...	...	...	...	...	3			
	Guelph	...	1	...	...	...	...	...	1			
	Peacemaker	...	1	...	...	...	...	...	1			
	Roseberry	...	1	...	...	...	...	...	1			
	Christmas Pearmain	...	...	10	...	...	...	...	10			
	Yorkshire Beauty	8	...	...	1	...	...	...	6			
	Kings Acre Pippin	...	...	8	...	...	...	...	5			
	Crimson Bramley	15	...	18	...	...	5	...	38			
	Royal Snow	...	...	10	...	...	...	...	10			
	Bramley's Seedling	15	...	16	...	...	14	...	44			
	Kings of Tompkins County.	1	...	7	2	...	...	...	10			
	Houbion	...	...	6	...	...	...	...	6	Bush.		
	Roundway Magnum Bonum.	6	...	...	...	...	8	...	8			
	Wellington	...	...	5	...	...	...	...	5			
	Lane's Prince Albert	14	2	17	...	10	11	300	354					
	Upton Pyne	...	1	8	6	...	6	...	41					
	Devon Queen	...	4	1	2	...	2	...	0					
	Renown	...	...	4	...	...	6	...	10			
	Stirling Castle	10	...	10	...	...	...	...	20			
	Golden Russet	...	...	6	...	...	...	...	6			
	Charles Ross	10	...	10	...	11	...	...	81			
	Bismarck	...	...	1	17	8	19	...	46			
	Eyns	...	8	...	...	...	...	...	6			
	Warren's King	...	...	...	...	...	11	...	11			
	Thomas Rivers	10	...	...	...	...	...	...	10			
	Grenadier	...	3	14	...	...	9	...	19			
	Rev. W. Wilks	10	...	6	...	...	6	47	78			
	Hounslow Wonder	...	1	20	...	...	6	...	27			

Species of fruit trees.	Variety.	Planted 1913-20.									Total number.	Description.		
		Upper garden.					Lower garden.	South-west block.						
		Top block.	South block.	East block.	North block.	East extension.								
1	2	3	4	5	6	7	8	9	10	11				
Apple trees	Newton Wonder ...	15	...	21	...	...	16	...		52		
	Red Victoria ...	...	4	11	...	3	10	...		28			
	Potis' Seedling ...	4	...	5	...	...	10	...		19		
	Hector McDonald ...	...	...	20	...	...	19	...		30		
	Emperor Alexander ...	...	9	...	...	...	...	...		9		
	Sandringham ...	...	...	...	...	5	...	...		5		
	Rougemont ...	...	...	...	...	6	...	...		6		
	Hamblings Seedling ...	...	...	...	...	6	...	...		6		
	Gabala ...	...	...	...	...	6	...	...		6		
	Baron Woysely ...	...	...	...	...	6	...	...		6		
	Loddington Seedling ...	...	...	...	...	6	...	...		6		
	Parroquet ...	...	...	...	...	6	...	...		6		
	Domino ...	13	...	...	...	...	...	...		13		
	Rival ...	...	...	16	...	11	...	...		27		
	Wadhurst Pippin ...	10	...	...	...	...	...	...		10		
	Court Pendu Plat ...	6	...	6	...	...	...	...		12	Bush.	
	Ecklinville Seedling ...	4	...	6	...	...	...	...		6		
	Early Red Margaret ...	...	...	10	...	...	...	...		10		
	Gascoyne's Scarlet ...	4	...	5	...	...	...	...		9		
	Spitzenberg ...	...	...	6	...	...	...	...		6		
	Braddicks Nonpariel ...	5	...	...	...	...	...	...		5		
	White Nonpariel ...	10	...	...	...	...	...	...		10		
	Baumann's Reinette ...	6	7	8	...	4	...	...		25		
	Pitmeadow Pineapple ...	10	...	...	...	...	...	...		10		
	Brownlee's Russet ...	16	...	...	...	...	...	...		10		
	Sturmer Pippin ...	5	6	15	...	...	20	...		46		
	Cardinal ...	...	...	9	1	...	...	...		10		
	Emmene Early ...	...	3	13	...	8	...	...		24		
	Langley Pippin ...	...	...	10	...	...	...	...		10		
	Wagener ...	...	...	0	...	...	...	...		9		
	Williams' Favourite ...	10	...	...	...	...	...	...		10		
	Scarlet Nonpariel ...	...	...	9	...	...	18	...		21		
	Coxe's Pomona ...	...	...	...	...	...	...	23		25		

Species of fruit trees.	Variety.	Planted 1913-20.										Total number.	Description.		
		Upper garden.					Lower garden.								
		Top block.	South block.	East block.	North block.	East extension.									
1	2	3	4	5	6	7	8	9	10	11					
Apple trees	Lord Burghley	...	1	...	...	...	4	2	...	7			
	St. Everard	...	6	...	...	...	5	...	...	11			
	Beauty of Bedford	...	4	...	...	...	7	...	...	11			
	Reinette dorée de Heusgen.	10	...	...	...	...	...	...	...	10			
	Cox's Golden Drop	...	...	...	...	...	6	...	...	6			
	Cox's Orange Pippin	...	4	...	...	...	...	15	...	19			
	Kerry Pippin	...	10	14	...	...	10	100	...	134			
	Golden Reinette	...	...	...	...	...	6	25	...	31			
	Peasgood's Nonsuch	...	...	25	...	...	14	...	...	39			
	Fearn's Pippin	...	...	12	...	...	6	...	...	18			
	Lady Sudeley	...	...	20	...	...	10	...	...	30			
	Devonshire Quarrenden	...	...	...	...	...	13	...	...	13			
	May Queen	...	10	...	...	...	...	...	...	10			
	Royal Jubilee	...	10	...	...	...	...	...	...	10			
	Missing Link	...	1	...	...	...	...	...	...	1			
	Roseberry	...	1	...	...	...	...	...	...	1			
	Crawle, Beauty	...	1	...	...	...	1	...	...	1			
	Mrs. Philimore	...	...	...	...	...	6	...	...	6			
	Lord Grosvenor	...	...	...	...	...	6	...	...	6			
	Blue Pearmain	...	...	...	...	...	4	...	...	4			
	Jefferson	...	...	...	...	...	7	...	...	7			
	Star of Devon	...	...	...	...	...	20	6	...	26			
	Yellow Ingester	...	...	...	...	...	...	6	...	6			
	Ardcairn Russet	...	7	5	1	11	5	...	...	29			
	Allington Pippin	...	18	5	...	...	4	...	...	25			
	William Crump	...	10	19	...	...	9	5	...	43			
	Worcester Pearmain	...	...	...	...	...	...	6	...	6			
	Herring's Pippin	4	6	3	...	51	1	...	...	65			
	Beauty of Bath	...	5	5	...	...	1	...	...	11			
	Ellison Orange	...	...	...	...	...	16	1	...	17			
	Ribston Pippin	...	4	...	...	...	6	...	...	10			
	Charles Eyre	...	...	3	...	14	1	...	...	18			

Species of fruit trees.	Variety.	Planted 1913-20.							Total number,	Description.		
		Upper garden.				Lower garden.	South-west block.					
		Top block.	South block.	East block.	North block.							
1	2	3	4	5	6	7	8	9	10	11		
	Syke House Russet	...	...	...	...	...	6	...	6	
	Spring Ribston Pippin	...	...	8	...	...	...	...	8	
	Mr. Gladstone	...	...	6	...	...	5	...	11	
	Golden Spire	...	...	14	...	...	9	...	23	
	Rosemary Russet	...	...	6	...	...	6	...	12	
	Duke of Devonshire	...	...	6	...	...	...	...	6	Bush.
	Early Peach	...	...	10	...	...	...	...	10	
	Newtown Pippin	...	2	8	...	...	6	...	16	
	American Mother	...	9	...	...	...	...	...	9	
	Encore	...	...	18	...	...	4	...	22	
	Irish Peach	...	6	...	...	...	...	...	6	
	Lord Stradbroke	...	...	...	...	6	...	...	6	
	Total	339	310	784	142	315	412	507	2,849			
Apple trees	Encore	...	...	6	...	...	...	5	11	
	Crimson Bramley	...	5	3	10	...	...	...	18	
	Rymer	...	...	...	...	...	8	...	8	
	Bramley's Seedling	...	...	8	12	...	...	...	20	
	Court of Wick	...	...	6	...	...	...	...	6	
	Irish Peach	...	...	...	6	...	...	...	6	
	Northern Greening	...	...	...	...	...	7	1	8	
	Norfolk Beesing	...	...	...	6	...	...	...	6	
	Newton Wonder	...	4	21	...	...	...	...	25	
	Stirling Castle	...	...	5	1	...	2	8	11	
	Aldington Pippin	...	...	...	...	...	2	...	2	
	Annie Elizabeth	...	...	...	...	9	...	1	10	
	Ellison's Orange	...	...	...	...	6	...	4	10	
	Belmsford Wonder	...	...	...	...	6	...	...	6	
	Lord Grosvenor	...	...	...	...	7	...	2	9	
	Christmas Pearmain	...	...	...	...	10	...	...	10	
	Baldwin	...	5	...	...	...	6	8	10	

Species of fruit trees.	Variety.	Planted 1913-20.									Description	
		Upper garden.					Lower garden.	South-west block.	Total number.			
		Top block.	South block.	East block.	North block.	East extension.						
1	2	3	4	5	6	7	8	9	10	11		
Apple trees	Beauty of Kent	...	...	...	...	...	...	6	6		
	Duchess of Oldenburg	...	...	6	...	...	...	...	...	6	
	Norfolk Bearer	...	...	5	1	...	...	...	...	6	
	King of Tompkins County.	...	...	6	...	...	...	...	...	6	
	Emperor Alexander	...	...	...	8	...	...	...	...	8	
	James Grieve	...	3	17	...	...	...	...	...	20	
	Cox's Pomegranate	...	...	2	4	...	...	...	...	6	
	Small's Admirable	...	...	6	...	...	...	...	...	6	
	New Hawthorden	...	...	3	...	...	...	...	...	3	
	Calville St. Saumur	...	7	...	...	...	8	...	15		
	ReINETTE de Cazy	...	8	...	...	...	5	...	15		
	Precocie David	...	3	...	...	...	2	...	5		
	Kashmir Amroo	...	3	...	...	...	...	...	...	3	
	Fenouillet Gris	...	4	...	...	...	3	6	12		
	Api Petit	...	1	4	1	...	2	...	8		Standard.	
	Delicious (Starks)	...	50	12	...	...	...	...	62		
	King David	...	26	13	...	...	...	36	75		
	York Imperial	...	...	6	...	...	...	...	...	6	
	Paragon Winesap (Starks)	...	...	5	...	...	...	...	...	5	
	Jonathan (Starks)	...	2	6	...	...	...	...	...	8	
	Black Ben (,,)	...	20	5	...	...	...	35	60		
	Stayman Winesap (Starks)	...	...	6	...	...	...	18	24		
	Senator (Starks)	...	1	4	...	...	...	...	...	5	
	Grimes Golden (Starks)	...	13	5	...	...	...	12	29		
	Sumner Champion (Starks)	...	2	...	...	...	...	...	...	3	
	Mother (Starks)	...	...	6	...	...	...	...	...	6	
	Emmene Early	...	...	10	...	...	...	...	...	10	
	Baumann's Reinette	...	...	10	...	...	...	...	...	10	
	Grenadier	...	...	8	...	...	...	...	...	8	
	Cox's Orange Pippin	...	...	14	...	...	...	...	...	14	

Species of fruit tree.	Variety.	Planted 1913-90.							Total number.	Description.		
		Upper garden,				Lower garden.	South-west block.					
		Top block.	South block.	East block.	North block.							
1	2	3	4	5	6	7	8	9	10	11		
	Bed Victoria	...	...	...	...	...	...	...	5	5
	Blenheim Orange	...	3	8	...	...	...	...	...	11
	Calville Blanc	...	...	6	...	...	...	...	...	6
	Norfolk Beauty	...	15	14	1	...	...	1	...	31
	Reinette du Canada	...	6	2	...	...	...	2	3	13
	Winter Greening	...	8	...	...	...	...	...	...	8
	Rev. W. Wilks	...	1	...	...	29	7	5	40	
	Lord Burghley	...	8	...	...	...	...	...	...	6
	Lady Henniker	...	4	6	...	...	...	...	...	10
	Golden Spire	...	4	4	...	...	...	...	...	8
	Bismarck	...	4	6	...	...	...	...	...	10
	Calville Rouge d'hiver	...	6	...	...	1	14	10	31	
	Charles Ross	...	3	2	...	4	3	6	18			
	Lord Derby	...	...	...	...	...	...	8	8	
177½ trees	Barnack Beauty	...	...	1	...	6	3	4	14	
	Herrings Pippin	...	3	...	...	16	...	...	19	
	Rival	...	2	...	...	6	...	7	15	
	Star of Devon	...	...	...	...	4	...	2	6	
	William Crump	...	...	...	...	5	...	...	5	
	Upton Pyne	...	...	...	...	15	...	5	20	
	Early Melon (Starks)	...	4	...	...	...	...	...	4	
	Wealthy (,)	...	4	...	...	...	...	...	4	
	Wilson's Red June (Starks)	...	6	...	...	...	...	...	6	
	Livealand Raspberry (Starks)	...	6	...	...	...	...	...	6	
	Worcester Pearmain	...	...	...	...	...	4	...	4	
	Tower of Glamis	...	...	...	4	...	...	6	6	
	Total	...	1	230	268	45	124	87	195	950		
	Blenheim Orange	11	11		
	James Grieve	4	...	4		
	Feltham Beauty	2	3	5		
	Lady Sudeley	...	3	3	...	5		
	Herring's Pippin	2	1	...	2	...	5		
											Horizontal trained.	

Species of fruit trees.	Variety.	Planted 1913-20,						Total number.	Description.		
		Upper garden.				Lower garden.					
		Top block.	South block.	East block.	North block.	East extension.					
1	2	3	4	5	6	7	8	9	10		
	Gascoyne's Scarlet	3	...	...	...	...	...	...	3
	Charles Ross	3	...	...	...	...	...	...	3
	Brownlee's Russet	3	...	...	...	...	...	2	5
	Baumann's Reinette	3	...	...	...	...	...	...	3
	Beauty of Bath	...	...	...	...	...	...	5	5
	Sturmer Pippin	6	...	...	...	...	...	...	6
	Cox's Orange Pippin	...	...	...	...	...	...	1	1
	Cox's Pomona	1	...	...	...	...	...	3	4
	King of the Pippins	...	...	3	...	...	...	2	5
	Kerry Pippin	...	...	...	...	...	...	1	1
	Claygate Pearmain	...	...	...	...	...	...	1	1
	King of Tompkins County.	...	...	3	...	...	...	...	3
	Sterling Castle	...	...	...	...	...	...	3	3
Apple trees	Total	...	21	...	10	15	...	27	73		
	Sturmer Pippin	...	...	...	8	...	...	...	8
	Mannington Pearmain	...	...	...	3	1	...	...	3
	Scarlet Golden Pippin	...	...	...	...	...	...	2	3
	Washington	2	...	...	2	2	...	...	4
	Allington Pippin	...	...	...	...	...	...	2	2
	Golden Spire	...	...	1	...	...	...	...	1
	Beauty of Bath	...	...	...	...	...	...	3	3
	Adams Pearmain	2	...	...	1	...	...	...	3
	James Grieve	...	...	...	...	...	...	2	2
	King of the Pippins	...	...	2	1	...	...	...	3
	Barnack Beauty	...	...	...	...	...	...	1	2
	King of Tompkins County.	...	...	...	4	...	...	...	4
	Total	...	4	...	0	15	...	10	34		

Species of fruit tree.	Variety.	Planted 1913-20.							Total number.	Description.		
		Upper garden.					Lower garden.					
		Top block.	South block.	East block.	North block.	East extension.						
1	3	3	4	5	6	7	8	9	10			
	Charles Ross ...	..	..	6	..	..	..	6		
	Rival ...	..	..	5	..	..	..	5		
	James Grieve ...	..	..	6	..	..	..	6		
	Blenheim Orange ...	..	..	6	..	..	..	6		
	Total ...	..	..	23	..	..	..	23		
Apple trees ...	Baumann's Reinette ...	..	4	..	..	..	..	4		
	Golden Spire ...	..	1	..	..	..	..	1		
	Total ...	..	5	..	..	..	..	5		
	Rival ...	..	..	3	..	..	..	3		Double Cordon.
	Total ...	..	..	3	..	..	..	3		
	Rival ...	..	..	3	..	..	..	3		Single Cordon.
	Total ...	..	..	3	..	..	..	3		

Species of fruit trees.	Variety.	Planted 1913-20.					Total number.	Description.		
		Upper garden.				Lower garden.				
		Top block.	West block.	South block.	East block.					
1	2	3	4	5	6	7	8	9		
Pear trees	Fertility ...	...	..	53	1	...	18	72
	St. Swithins ...	...	...	...	...	...	9	9
	Beurre Hardy ...	...	...	17	1	...	2	20
	Red October ...	...	...	...	...	...	8	8
	Beurre d'Anjou ...	...	...	6	...	...	...	6
	Parrot ...	...	...	1	...	...	10	10
	William's Bon Chretien ...	...	...	13	...	...	...	13
	Seedling Bergamot ...	...	...	...	...	...	6	6
	Fondante Thirriot ...	...	...	9	...	...	10	19
	Dr. Hogg ...	...	...	...	...	...	7	7
	Triomphe de Vienne ...	...	...	8	...	...	...	6
	Beacon ...	...	...	...	4	...	6	10
	Beurre de Naghan ...	...	...	...	...	...	4	4
	Charles Ernest ...	...	...	12	...	...	...	12
	Roosevelt ...	...	...	...	...	...	6	6
	Doyenne d'Ete ...	...	...	10	...	...	...	10
	Blickling ...	...	...	...	...	...	6	6
	Gauvain Bergamot ...	...	...	6	...	...	...	6
	Santa Claus ...	...	...	...	...	...	6	6
	Josephine de Malines ...	...	...	6	...	...	9	15
	Precoce de Juillet ...	...	...	...	...	...	5	5
	Dr. Jules Guyer ...	...	...	11	...	...	6	17
	Madame Treyve ...	...	...	...	...	...	10	10
	Durondeau ...	...	...	7	1	...	2	10
	Hessle ...	...	...	5	...	...	14	19
	Beurre d'Amanlis ...	...	...	12	...	...	10	22
	Emile d'Hayet ...	...	...	5	...	...	10	15
	Marie Benoist ...	...	...	5	...	...	...	6
	Clapp's Favorite ...	...	...	5	...	...	10	15
	Louise Bonne of Jersey ...	...	2	40	...	...	...	42
	President Barabe ...	...	...	5	...	...	...	5
	Thompson ...	...	...	5	...	...	...	5
	Winter Nelis ...	...	...	5	...	...	...	4
	Marguerite Marillat ...	...	...	5	...	...	...	6
	Seckle ...	...	...	5	...	...	...	6
	Beurre Fonquerry ...	...	...	5	...	...	...	6

Bush and
Pyramid.

Species of fruit trees.	Variety.	Planted 1913-20.					Total number.	Description.		
		Upper garden.				Lower garden.				
		Top block.	West block.	South block.	East block.					
1	2	3	4	5	6	7	8	9		
	Directeur Hardy	...	...	...	5	...	...	5
	Colmar d'Ete	...	...	6	6	...	...	12
	Princess	...	...	6	6	...	...	12
	Belle Julie	...	...	6	6	...	...	12
	Doyenne du Comice	...	...	1	4	...	...	5
	Total	...	230	86	...	174	490			
Pears	Beurre Hardy	...	...	18	...	...	5	18
	Clapp's Favourite	...	...	10	...	...	...	10
	Duvondec	...	...	9	...	...	...	9
	Madame Treyve	...	...	10	8	...	...	15
	William's Bon Chretien	...	...	7	...	...	5	12
	Marguerite Marillat	...	...	14	...	...	5	19
	Doyenne du Comice	...	...	10	...	...	5	15
	Fondante Thiriot	...	...	...	5	...	...	5
	Louise Bourne of Jersey	...	...	10	...	...	1	11
	Conference	...	...	9	...	...	5	14
	Emile d'Heyst	...	...	9	...	...	...	9
	Winter Nelis	...	...	6	...	...	...	5
	Fondante d'Automne	...	...	...	5	...	...	5
	Beurre Superfin	...	...	...	...	...	...	5
	Princess	...	...	...	5	...	5	10
	Beurre Fouqueray	...	...	...	5	...	...	5
	Beurre Dicil	...	...	...	...	...	5	5
	Directeur Hardy	...	...	5	5	...	...	5
	Beurre d'Anjou	...	...	...	...	...	5	5
	Colmar d'Ete	...	...	...	5	...	...	5
	Total	...	106	85	...	40	177			
Horizontal trained.	Directeur Hardy	...	5	5	...	...	10	
	Duchess d'Angouleme	...	1	...	...	...	1	
	Clapp's Favourite	...	2	...	...	...	2	
	Josephine de Malines	...	1	...	...	...	1	
	Emile d'Heyst	...	2	...	...	...	2	
	Louise Bourne of Jersey	...	1	...	...	...	1	

Species of fruit trees.	Variety.	Planted 1913-20.						Total number.	Description.		
		Upper garden.				Lower garden.					
		Top block.	West block.	South block.	East block.						
1	2	3	4	5	6	7	8	9	10		
	Beurre Superfin ...	...		1	...	...	...	1	
	Prince ...	...	6	...	...	...	...	6	
	Conferencier ...	...	2	...	...	...	...	2	
	Dr. Jules Guyot ...	...	2	...	...	...	...	2	
	Durondeau ...	...	1	...	...	...	...	1	
	Pitmaston Duchess ...	...	1	...	...	...	...	1	
	Fondante d'Automne ...	...	1	...	...	...	...	1	
	Doyenne du Comice ...	...	3	...	...	...	...	3	
	Winter Nelis ...	4	...	...	...	...	...	4	
	Marguerite Marillat ...	...	5	...	...	...	...	5	
	Total ...	...	4	33	6	...	...	42	
Pear trees.	Kashmit ...	...	...	...	...	9	...	9	
	Marguerite Marillat ...	...	...	6	...	...	...	6	
	King Karl (Starks) ...	...	...	...	3	...	...	3	
	Anjou ( ) ...	...	1	...	6	...	...	7	
	Lincoln ( ) ...	...	3	...	5	...	...	5	
	Rowell ( ) ...	...	4	...	5	...	...	9	
	Duchess ( ) ...	...	3	...	1	...	...	4	
	Bartlett ( ) ...	...	6	...	3	...	...	11	
	Seckle ( ) ...	...	3	...	3	1	...	6		
	Marie Louise ...	...	2	...	...	...	...	2	
	Dr. Jules Guyot ...	...	5	11	...	...	...	18	Standards
	Conference ...	...	2	...	...	...	...	2	
	Emile d'Heyst ...	...	3	...	...	...	...	3	
	M. dame Treyve ...	...	8	...	...	...	...	8	
	Count de Lamy ...	...	3	...	...	...	...	3	
	Louise Bonne of Jersey ...	...	2	...	...	...	...	2	
	Beurre Capiaumont ...	...	6	...	...	...	...	6	
	Princess ...	...	3	...	...	...	...	3	
	Doyenne du Comice ...	...	2	...	...	...	...	2	
	William's Bon Chretien ...	...	3	...	...	...	...	3	
	Souvenir du Congress ...	...	3	...	...	...	...	3	
	Marie-Louise d'Uccle ...	...	3	...	...	...	...	3	
	Fertility ...	...	28	...	3	3	...	33		
	William bon Chretien ...	...	...	...	6	...	...	6	
	Belle Julie ...	...	...	...	4	...	...	4	

Species of fruit trees.	Variety.	Planted 1918-20,						Total number.	Description.		
		Upper garden.				Lower garden.					
		Top block.	West block.	South block.	East block.						
1	2	3	4	5	6	7	8	9			
	Seckle ...	1	...	...	2	...	...	2	
	Bartlett Hybrid (Starks)	...	...	...	3	...	...	8	
	Fame (n)	...	...	...	2	...	2	4	
	Reihl Best (n)	...	...	...	4	1	1	5	
	Boussoek (n)	...	...	...	3	1	1	4	Standards.
	Triumph (n)	...	...	...	3	...	...	3	
	Winter Bartlett (n)	...	...	2	3	4	4	7	
	Comice (n)	...	...	...	2	2	2	4	
	Total	...	...	11	19	67	13	120	
Apples:	Princess ...	...	...	4	...	...	...	4	
	Conference	...	...	...	...	...	3	3	
	Madame Treyve	...	...	5	...	...	...	5	
	Marie Louise d' Uccle	...	...	...	...	4	4	4	
	Louise Bonne of Jersey	...	...	...	...	4	4	4	
	Beurre Hardy	5	...	...	...	...	...	5	
	Fondante d' Automne	...	...	...	...	3	3	3	
	Winter Nelis ...	...	...	...	4	...	4	4	
	Conseiller de la Cour ...	...	...	...	...	3	3	3	
	Doyenne du Comice ...	...	...	...	...	3	3	3	
	Marguerite Marillat ...	4	1	...	...	...	...	5	
	Total	...	9	5	5	5	20	43			
									Upright trained.		

Species of fruit tree,	Variety,	Planted 1913-20.						Description,	
		Upper garden,			Lower garden.	South-west block.	Total number.		
		Top block.	South block.	East block.					
1	2	3	4	5	6	7	8	9	10
	Late Transparent ...	...	...	...	...	6	...	6	
	Guthrie's Late Gage ...	...	4	...	...	...	...	4	
	Dunston's Superb Guage ...	...	3	...	...	10	...	13	
	White Botan ...	...	1	...	...	...	2	3	
	Satsuma ...	...	2	...	...	1	3	6	
	Burbank ...	...	2	...	...	...	1	3	
	Prosperity ...	...	5	...	...	...	...	5	
	Reine Claude de Bayay ...	...	3	...	...	...	...	3	
	Belle de Louvain ...	...	...	...	...	6	...	6	
	Curlew ...	...	5	...	...	...	...	5	
	Utility ...	...	2	...	...	...	1	3	
	Greengage ...	...	1	...	...	1	4	4	
	Cox's Emperor ...	...	4	...	...	...	...	4	
	Heron ...	...	5	...	...	...	...	5	
	Mitchelsons ...	...	8	...	...	...	...	8	
Plum trees ...	Monarch ...	...	...	3	...	...	...	3	Bush.
	Ickworth ...	...	2	...	...	...	...	2	
	Stark's Gold ...	...	8	...	...	...	...	8	
	Diamond ...	...	3	...	...	...	...	3	
	Belgian Purple ...	...	1	...	...	10	...	11	
	Bittern ...	...	5	...	...	...	...	5	
	Rutland Plumcot ...	1	...	...	...	...	...	1	
	Primate ...	...	5	...	...	...	...	5	
	Pond's Seedling ...	...	7	...	...	9	...	10	
	Admiral ...	...	5	...	...	...	...	5	
	Stark's Shiro ...	1	...	...	...	...	...	1	
	President ...	...	6	...	...	...	...	6	
	Stark's Omaha ...	...	...	1	...	1	...	2	
	Jefferson ...	...	2	...	...	...	...	2	
	Autumn Beauty ...	...	...	1	...	...	...	1	
	Wycliffe ...	...	3	...	...	...	...	3	
	King of the Dawsons ...	...	...	...	...	2	...	2	
	Kirk Blue ...	...	3	...	...	...	...	3	

Species of fruit tree.	Variety.	Planted 1913-20.								Description.	
		Upper garden.				Lower garden.	South-west block.	Total number.			
		Top block.	South block.	East block.	North block.						
1	2	3	4	5	6	7	8	9	10		
	Shepherd's Bullace ...	...	...	...	...	3	...	3		
	Czar ...	...	6	...	...	...	...	6		
	Langley's Bullace ...	...	...	...	...	3	...	3		
	Victoria ...	...	6	...	...	...	...	6		
	White Damson ...	...	...	...	...	3	...	3		
	Prince Englebert ...	...	8	...	...	...	...	8		
	Prune Shropshire ...	...	...	...	...	3	...	3		
	Kashmir Greengage ...	...	4	...	...	...	...	4		Bush.
	Merryweather Damson ...	...	...	...	...	10	...	10		
	Count d'Althan gage ...	...	1	...	...	...	...	1		
	Stark's America ...	...	...	2	...	...	...	2		
	Stint ...	...	1	...	...	...	...	1		
	Burbanks Giant Prune ...	...	8	...	...	4	...	12		
	Yellow Pershore ...	...	...	...	...	1	...	1		
	Total	...	5	116	7	...	87	11	206		
Plum trees	Decaisse ...	...	...	...	...	1	...	1		
	Kirkles ...	...	...	...	...	2	...	2		
	Jefferson ...	...	...	...	...	2	...	2		
	Mallard ...	...	...	...	...	1	...	1		
	Golden Esperen ...	...	...	...	...	1	...	1		
	Oullin's Golden Gage ...	...	...	...	...	2	...	2		
	Boine Claude d' Althan.	...	...	...	...	1	...	1		Fan trained.
	Early Transparent ...	...	...	...	...	1	...	1		
	Coe's Golden Drop ...	...	...	...	...	1	...	1		
	Transparent Gage ...	...	...	...	...	1	...	1		
	Greengage ...	...	...	...	...	2	...	2		
	Golden Transparent Gage.	...	...	...	...	1	...	1		
	Belgian Purple ...	...	...	...	...	1	...	1		
	Total	...	...	...	...	17	...	17		

Species of fruit trees.	Variety.	Planted 1913-9.									Description	
		Upper garden.				South-west block.						
		Top block.	South block.	East block.	North block.	Lower garden.	South-west block.	Total number.				
1	2	3	4	5	6	7	8	9	10			
Cherry trees ...	Morello	16	...	3	3	...	22	Tram.		
	Kentish ...	...	...	12	...	...	12	...	24
	Bigarreau Kentish ...	...	...	...	...	...	3	...	3
	Gloire de France ...	...	...	1	...	...	...	...	1
	White Heart ...	...	...	...	...	...	4	...	4
	Black Heart ...	...	...	...	...	...	5	...	5
	Kashmir ...	...	...	22	...	...	4	...	26
	Montmorency King ...	...	...	2	...	...	1	...	3
	Burbank ...	...	...	4	...	...	1	...	5
	Total	...	...	57	...	3	83	...	93	
	Turkey Black Heart ...	...	...	...	...	...	1	...	1
	Late Black Bigarreau ...	...	...	...	...	...	1	...	1
	Frogmore Bigarreau ...	...	...	...	...	...	1	...	1
	Noir de Guben ...	...	...	...	...	...	1	...	1
	Belle de St. Trone ...	...	...	...	...	...	1	...	1
Orange trees ...	Early Rivers	1	...	1	Fan trained.		
	Total	...	...	...	...	...	6	...	6
	Japanese Satsuma ...	...	...	1	...	...	1	...	2
	Japanese Kumquat ...	...	...	8	...	...	4	...	12
	Malta Blood ...	...	...	14	...	...	2	...	16
	St. Michael's ...	...	...	13	...	...	1	...	14
	Jaffa ...	...	...	2	...	...	1	...	3
	Malta Oval ...	...	...	2	...	...	1	...	3
	Silver ...	...	...	3	...	...	1	...	4
	Excelsior ...	...	...	1	...	...	1	...	2
	St. Michael's Tangerine ...	...	...	1	...	...	5	...	6
	St. Michael's Dom ...	...	...	1	...	...	2	...	3
	St. Michael's Louise ...	...	...	1	...	...	1	...	2
	St. Michael's Sustaining ...	...	...	1	...	...	1	...	1
	Ditto Achilles ...	...	...	...	...	...	1	...	1
	Total	...	...	47	...	...	21	...	68

Species of fruit trees.	Variety.	Planted 1913-20.						Total number.	Description.		
		Upper garden.				Lower garden.	South-west block.				
		Top block.	South block.	East block.	North block.						
1	2	3	4	5	6	7	8	9	10		
Lime and Lemon trees.	Kazla Lime	...	...	1	2	...	...	3	
	Imperial Lemon	...	...	...	...	...	2	2	
	Gora Lime	...	...	3	1	...	...	3	
	Bijou Lemon	...	...	...	...	...	4	4	
	Kagzi Lime	...	...	4	...	...	...	4	
	Total	...	...	7	8	...	6	...	16
Walnut trees ...	Dwarf Prolific	...	...	7	...	...	10	...	17
	Kashmir ...	...	...	6	2	...	...	...	8
	Total	...	...	13	2	...	10	...	25
Peach trees ...	Princess of Wales	...	...	...	...	3	...	...	3
	Peregrine ...	...	...	...	...	...	14	...	14
	Alexander ...	...	...	...	...	...	13	...	13
	Duke of York	...	...	...	...	...	17	...	17
	Exquisite ...	...	...	...	...	...	2	...	2
	Late Devonian	...	...	...	...	...	1	...	1
	Lady Palmerston	...	...	...	...	...	2	...	2
	Kestrel ...	...	...	...	...	...	5	1	6
	Hales Early	...	...	...	...	...	1	2	3
	Bellegarde	...	...	...	...	...	...	3	3
	Total	...	...	...	...	3	55	6	64
Apricot trees ...	Superb (Starks)	...	...	...	...	...	1	...	1
	Blenheim ...	...	...	...	...	...	6	...	6
	Kashmir ...	...	...	7	...	...	...	...	7
	Total	...	...	7	...	...	7	...	14

Species of fruit trees.	Variety.	Planted 1913-20.						Description,	
		Upper garden.			Lower garden.				
		Top block.	South block.	East block.	North block.	South-west block.	Total number.		
1	2	3	4	5	6	7	8	9	10
Quince trees ...	Meeks Prolific	...	...	1	...	...	1	...	2
	Champion ...	...	...	1	...	...	...	...	1
	Portugal ...	...	...	1	...	...	1	...	2
	Total	...	...	3	...	...	2	...	5
Almond trees ...	Hill Almond	...	...	12	...	...	...	...	12
	Total	...	...	12	...	...	...	...	12

Species of fruit trees.	Variety.	Planted 1918-20.						Description.	
		Upper garden.		Lower garden.		South-west block.	Total number.		
		South block.	East block.	North block.					
1	2	3	4	5	6	7	8		
Whoherry ...	...	...	...	...	...	8	8	Berries.
King's Acre Berry	...	...	...	...	...	5	5	
Leganberry	...	...	...	...	...	3	3	
Phenomenal	...	...	...	...	...	3	3	
Lationberry	...	...	...	...	...	3	3	
Rhuberry ...	Blowers ...	...	...	...	100	...	100	
Dlite ...	Pyno's Giant Himalaya Berry of California.	...	...	...	100	...	100	
	Total	...	...	...	200	14	220	
Strawberry	Givon's late Prolific...	...	...	...	...	200	200	
	Louis Gauthier	...	...	...	200	...	200	Plants.
	Royal Sovereign	5,000	...	...	...	5,000	6,000	
	Total	5,000	...	...	200	5,200	6,400	
Currant ...	Boskoop Giant Black...	...	2	...	...	...	2	
	Blacksmith	4	...	...	...	...	6	
	Defender Black	...	1	...	...	...	1	
	Victoria Black	5	...	...	...	...	5	
	Southwell's Black	...	6	...	...	...	6	
	White La Versaille ...	4	...	...	...	...	4	
	Total	...	18	9	...	...	22	
Walnut	White Filbert	...	...	...	2	...	2	
	Red Filbert	...	...	...	3	...	3	Trees.
	Prize Cob ...	...	...	...	3	...	3	
	Kentish Cob	...	...	...	3	...	3	
	Total	...	...	...	11	...	11	

Species of fruit trees,	Variety,	Planted 1913-20.						Description,	
		Upper garden,			Lower garden,	South-west block.			
		South block.	East block.	North block.					
1	2	3	4	5	6	7	8	9	
Grape Vines	Campbell's Early (Starks)	...	2	...	...	...	2	
	Hicks (Starks)	...	3	...	...	...	3	
	King (")	...	2	...	...	...	2	
	Eclipse (")	...	1	...	...	...	1	
	King Philip(")	...	2	...	...	...	2	
	Wilder (")	...	2	...	...	...	2	
	Worden (")	...	2	...	...	...	2	
	Niagara (")	...	2	...	...	...	2	Vines.
	Total	...	16	...	...	...	16	

Summary of Fruit Trees planted to 31st March 1920.

							Total
							2
							1
Bush Apple trees	...	...	...	...	...	...	2,849
Standard "	...	...	...	...	...	...	950
Horizontal trained Apple trees	...	...	...	...	...	...	73
Upright "	"	"	"	...	...	...	34
Palmetto Verrier "	"	"	"	...	...	...	23
Fan "	"	"	"	...	...	...	5
Double Cordon "	"	"	"	...	...	...	3
Single "	"	"	"	...	...	...	3
Bush and Pyramid Pear	"	...	...	...	...	...	490
Single Cordon "	"	...	...	...	...	...	187
Horizontal trained "	"	"	...	...	...	...	42
Standard "	"	"	...	...	...	...	190
Upright trained "	"	"	...	...	...	...	43
Bush Plum trees	...	...	...	...	...	...	206
Fan trained Plum trees	...	...	...	...	...	...	17
Cherry standard trees	...	...	...	...	...	...	93
Cherry fan trained trees	...	...	...	...	...	...	6
Orange trees	...	...	...	...	...	...	68
Lemon "	...	...	...	...	...	...	16
Nahaut "	...	...	...	...	...	...	25
Peach "	...	...	...	...	...	...	64
Apricot "	...	...	...	...	...	...	14
Quince "	...	...	...	...	...	...	5
Almond "	...	...	...	...	...	...	12
Wineberry	...	...	...	...	...	...	6
King's Acre berry	...	...	...	...	...	...	5

							Total.
	1						2
Loganberry	3
Phenomenal Berry	3
Laxtonberry	3
Blower's Blackberry	100
Giant Himalaya Blackberry	100
Strawberry plants	6,400
Currant Bushes	22
Nut	11
Grape Vines	16

C. H. HOLDER,

The 15th May 1920.

In charge, Fruit Experiment
Station, Shillong.

Statement showing the Receipts and Expenditure of the Fruit Experiment Station, Shillong, from 1st April 1919 to 31st March 1920.

Receipts.	Amount.	Expenditure.	Amount.
1	2	3	4
	Rs. a. p.		Rs. a. p.
Sale-proceeds of Apples ...	824 6 0	Allowance to Superintendent	3,000 0 0
" of Pears ...	32 4 0	Establishment ...	2,400 0 0
" of Peaches...	5 0 0	Petty construction ...	881 10 0
" of Straw- berries.	12 4 0	Instruments, Appliances, Apparatus and Machinery.	38 1 0
		Wages of labourers ...	3,175 8 0
		Seeds, Plants and Manures	1,359 10 0
		Service postage ...	30 0 0
		Other charges ...	638 9 8
Total Receipts ...	873 14 0	Total Expenditure ...	11,523 6 3

REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE
31ST MARCH 1920.

1. This station was established in January 1914. It is situated on the Sylhet-Silchar Road, $3\frac{1}{2}$ miles to the west of the Subdivisional Station of Karimganj, which lies on the Assam-Bengal Railway.

The total area of the farm is a little under 80 acres. Leaving out a compact block of 8 acres which has been set apart for the farm-stead and quarters for the staff, and the area covered by roads, drains and aids estimated at 12 acres, the net area available for cultivation is about 60 acres.

2. The farm lies close to the Langai river which occasionally rises in high flood and lays the country all round under water. This liability to floods is characteristic of the rice lands in the locality.

The soil of the greater portion of the farm is a deep alluvial clay of fine texture, though not particularly heavy. In the higher portions, it is somewhat lighter in character and may be described as a medium loam.

The farm is primarily a rice farm and out of 60 acres of arable area 55 acres is fit for paddy only. On the remaining portion, jute and rabi crops can be grown only under favourable conditions.

The soil has been recently analysed by the Agricultural Chemist and the results are shown below with his remarks.

	Laboratory No. 194, Block B and F Surface soil per cent.	Laboratory No. 195, Block C Surface soil per cent.
1	2	3
A.—Soluble in 26 per cent. Hydro-Chloric Acid with 48 hours digestion at 100° Phosphoric Acid (P_2O_5).	0·082	0·058
Potash (K_2O)	0·743	0·597
Lime (CaO)	0·243	0·442
Magnesia (MgO)	0·506	0·435

	1	2	3
	Laboratory No. 194, Block B and F Surface soil per cent.	Laboratory No. 195, Block C Surface soil per cent.	
B.—Available, i.e., soluble in 1 per cent. citric acid with 7 days digestion Dyer's method Phosphoric Acid (P_2O_5).	0.003	0.008	
Potash (K_2O)	0.004	0.005	
C—Moisture in air-dry soil	1.68	2.00	
Loss on ignition (organic matter and combined water).	3.69	4.76	
Nitrogen	0.089	0.121	
Calcium Carbonate	Trace	Trace	
Reaction	Acid	Acid	

N. B.—Percentages are expressed on air-dry materials.

- (a) Lime is deficient and the ratio of magnesia to lime is high; this is probably not of so great importance from the point of view of paddy cultivation as it would be in the case of many other crops. Experiments on small dressing of 5 or even ten maunds lime per acre might perhaps give results in combination with green manuring and the use of phosphate.
- (b) Both total and available phosphate are on the low side; experiments using basic slag, superphosphate and bone dust on a basis of a given quantity of phosphoric acid per acre might be tried.
- (c) Total potash is very high and available supplies would appear to be on the border land. Small dressings of potash may show results in the case of paddy.
- (d) Nitrogen is quite fair in sample number 195 and average in 194. I am of opinion, however, judging by the soil's behaviour in the laboratory that nitrogen is

not in a very available condition and a good response might follow moderate nitrogen dressings.

- (e) An increase in the humus content would seem desirable. Green-manuring and the regular use of cowdung as manure would help matters. For paddy, however, I would not advise excessive dressing of cowdung.

The experiments already in progress on the farm are very much on the lines suggested by the chemist. Experiments with phosphates and potash will be laid down during the year.

3. Considerable changes were made during the year in the Reclamation, Construction and repairs. equipment of the farm. As the godown space is very inadequate, a new godown is under construction and is expected to be finished within May. One of the rooms of the godown will be used for laboratory and will, it is hoped, afford considerable facilities for weighing and measurements of small quantities of paddy grains of the experimental plots which have to be carried out indoors.

All the residential quarters have been thoroughly repaired. A cart has been procured, which is expected to effect considerable saving in carrying paddy from fields to godown. The roads have also been considerably improved.

There is hardly any field on the farm high enough for the successful cultivation of sugarcane or *rabi* crops. An acre of semi-high land (which was not low enough for *sail* paddy nor high enough for *rabi* crops) has been raised and will afford facilities for the trial of *rabi* crops.

A cattle shed and a second apprentice's quarters are now urgently wanted. The cattle-shed will be taken up immediately and about 50,000 bricks have been burnt for the purpose. It is hoped to finish the shed before the rainy season begins. The apprentice's quarters will be taken up when the funds permit.

4. There was a severe attack of Rinderpest amongst the farm bullocks in February which carried off Cattle. 6 animals. Another old bullock died of hemoplögia. They will be replaced immediately.

5. The season was unfavourable for *aus* and *sail* paddy, as well as for *rabi* crops. The actual and normal rainfall are shown below:—

		Actual.	No. of rainy days.	Normal rainfall.
	1	2	3	4
April 1919	...	8.12	11	18.41
May "	...	10.65	16	22.20
June "	...	17.63	23	30.48
July "	...	18.77	22	23.85
August "	...	14.17	17	22.54
September "	...	28.82	22	18.42
October "	...	6.23	9	8.42
November "	...	5.93	2	1.23
December "	...	nil	nil	0.53
January 1920	...	nil	nil	0.94
February "	...	8.01	7	1.59
March "	...	14.47	13	8.63
Total	...	125.80	142	157.24

Between the 27th July and 5th September there was only 15.87 inches of rainfall, of which 7.19 inches fell in 3 days. The Experimental area had to be transplanted with irrigation, and the transplanting of the remainder of the area was late owing to scanty rainfall in the normal period.

A rainfall of 3.93 inches in November interfered with *rabi* sowing and did considerable damage to newly planted potatoes, necessitating the re-sowing of many plots. Comparatively heavy rainfall in February and March again damaged the *rabi* crops which were nearing maturity. The farm was, however, fortunately free from any flood.

6. As befits a station situated in such an extensive rice-growing district as the Surma Valley, attention is devoted mainly to effecting improvements in this staple.

Rice-breeding experiments were arranged in 1914, after a consultation between Mr. A. G. Birt, Deputy Director of Agriculture, Rai Bahadur B. C. Basu, Special Officer for Agriculture, and Mr. G. P. Hector, Economic Botanist, Bengal. These experiments have been carried on since with slight additions and alterations.

An account of the methods adopted, together with the various modifications which circumstances have since rendered necessary, will be found in the previous Annual Reports. The selection work has so long been restricted to early broadcast *aus* and transplanted winter rice. The latter known by the general name of *sail* forms the most important class of rice grown in the province. During the present year a collection of transplanted *aus* and *asra* or shallow *aman* paddy will be grown with a view to regular selection work being undertaken from next year. Similar work will also be started with *boro* paddy during the coming season. Both of these types occupy comparatively large areas in this District.

In the past two years a number of types of both *aus* and *sail* has been discarded as unsuitable; the remaining types were retained as being worth further trial. With the object of finally selecting one or two of the heaviest yielding types of each class, the following method is now being adopted. A few of the types in each class which have shown specially good qualities in single plots have been selected and are being tested against one good type which is taken as a standard, each of the other types being grown alongside the standard type twenty-five times. Small plots are of necessity used; each consisting of 14 lines of 14 plants or 196 plants in all. By repeating the tests in this way, accidental differences due to soil or water level is eliminated and the average of the yields obtained should be a reliable indication of the cropping powers of each type tested. The types which come out best will be recommended to cultivators. At the same time new varieties are sent by the Agricultural Inspectors every year and added to the list of types kept under observation.

Fifty-six types of early broadcast *aus* are now being dealt with. These have been grown side by side since the work was started, and from a comparison of their cropping and the other qualities have now been divided into two lots. One lot contains ten types and belongs to the *Dumai* sub-class, which is one of the quickest maturing classes of rice known. The other lot contains 46 types and belongs to the *murali* sub-class. Three types have been selected from among the first lot, and six from the second lot, as superior to the remainder. These are being tested according to the above method. The result will be published after trial for another year. At the same time all our *aus* varieties, 56 in number, will be kept under observation in the present season by growing a further generation of pure line seed in standard plots of 196 plants.

From the *sail* types which we have tried up to date a total of 105 was grown in a single series of standard plots in the last year. The Economic Botanist, Bengal, who visited the farm in

August, assisted in doing a certain amount of selection work. On his recommendation in 1918 four of what seemed the best types were selected for a thorough test against Indra *sail* as a standard. Three more are being added in this test during the coming season. In addition to the above, 133 varieties are being treated in single plots, including 28 new varieties received from the Agricultural Inspectors during the year. The number of paddy varieties dealt with during the last season were

<i>Aus</i>	...	56
<i>Sail</i>	...	105

60 new varieties are being added to the list during the coming season.

Trial of selected sail varieties.—The results of the test of the five selected varieties in the 25 plots are given below:—

Variety.	Average yield per 100 plants, in to'as.		Average number of tillers per plant.
	1	2	
Indra <i>sail</i>	7.06
George <i>sail</i>	138.755	5.21
Ati <i>sail</i>	128.393	7.25
Siemara	103.847	3.24
Brahmeg	122.000	5.24

In order to test the selected rices on a large scale, before recommending them to the cultivators, they were grown on a large number of plots of $\frac{1}{10}$ acre each on different levels. The results of the last two years are noted below:—

	Average yields per acre in pounds.		
	1918.	1919.	
1	2	3	
Indra <i>sail</i>	2,732	2,361
Ati <i>sail</i>	2,482	2,246
George <i>sail</i>	2,350	2,052

Both Indra *sail* and George *sail* may now be safely recommended to the cultivators of this valley. Dholmeg tilled very well in the beginning of the growing season, but the outturn was disappointing. There are indications that it may prove a good variety for low lands, but this must be further tested.

The selection work has now reached the stage when its bearing on the Agricultural work in the district becomes evident.

From the last year selected types are being tested in areas outside the farm by the local Agricultural officers, and the results obtained by these officers will be utilised in arranging the detail of future work.

Indra *sail* and George *sail* have generally given good results where tried throughout the Surma Valley.

7. The following minor experiments were carried out on a small scale :—

- (1) Bonemeal as a manure for double cropped land.
- (2) Green-manuring for rice crop.
- (3) Trial of late transplanted rice.

(1) *Bonemeal as manure for double cropped land.*—The first crop of 1915 and the second crop of 1916 were injured by floods and no results were available. The yields, as far as they have been obtained for five years, are shown below in tabular form :—

	Yield per acre, in pounds.					
	1915 2nd crop.	1916 1st crop.	1917 Two crops.	1918 Two crops.	1919 Two crops.	Avg
1	2	3	4	5	6	
Bonemeal, 247 pounds per acre in alternate years.	3,336	1,637	4,484	2,812	1,537	
No manure ...	2,788	1,435	4,164	2,300	1,317	
Bonemeal, 494 pounds per acre in alternate years.	2,962	1,570	4,277	2,142	1,412	
No manure ...	3,013	1,536	4,066	2,250	1,392	
Bonemeal, 247 pounds per acre yearly.	2,902	1,605	3,812	2,250	1,153	
No manure ...	3,065	1,475	3,353	2,451	1,160	

The results are very fluctuating and can only be regarded as of any use for qualitative rather than for quantitative purposes. This experiment will be carried out for another year, but the results so far do not appear to be very hopeful. There is no doubt, however, that the only application which is likely to be economical is that of 247 pounds in alternate years.

(2) *Green-manuring for rice crop.*—This experiment was started in 1915 with cowpea and *dhainchā*, and continued since with slight modifications. Duplicate plots were originally treated with ground limestone at 823 pounds per acre in 1916. The same series of plots were again green cropped in 1917 and 1918, and the average yields for the four years were as follows :—

	Pounds per acre.
No manure	... ... ... ... 1,635
<i>Dhainchā</i> alone	... ... ... ... 1,994
Cowpea alone	... ... ... ... 1,669
No manure	... ... ... ... 1,756
<i>Dhainchā</i> and 823 pounds ground limestone in 1916	... 2,129
Cowpea and 823 pounds ground limestone in 1916	... 1,960

This experiment was carried out last year on new plots with *dhainchā* alone, as cowpea was very difficult to plough in. The average outturn of paddy from the treated and untreated plots were as follows :—

	L.s.
Manured	... ... ... 2,501
Unmanured	... ... ... 1,895

The effect of green-manuring is quite evident and as it is a inexpensive manure, its use is to be largely advocated.

(3) *Trial of late transplanted rice.*—Owing to the risk of damage occurring at any time of the paddy growing season, it advisable to have a few varieties with as great a range of growth period as possible. With this object *jaria* from Sylhet and *edhi sail* from Bengal have been grown for the past three yrs. These paddies bear transplanting later in the season than other *sail* varieties. So far, they seem to be promising varieties but they must be grown for a number of years before any definite conclusions can be drawn.

8. *A combined variety and manurial experiment on jute.*—
Jute. The experiment with jute consisted of a combined variety and manurial experiment. The variety known as Dhaleswary was tested against the Kakaya mbai which is a pure line selected by the Fibre Expert, Bengal,

at Dacea. The average outturn of fibre in pounds per acre for the past five years was as follows :—

Yield per acre, in pound.	Kakaya Bombay	Local Dhaleswari	
	1	2	3
1915	2,736	1,224
1916	1,734	1,115
1917	1,441	1,391
1918	1,625	1,183
1919	2,767	2,588
Average	1,920	1,471

During the first three years the local variety used was Boranali. Since 1918, Dhaleswari, which is said to be a superior local variety, is being used. In all cases the superiority of K. B. Jute has been invariably and definitely established. It may be mentioned here that over seventy maunds of K. B. Jute seed has been sold in Habiganj during the year at Rs. 22.8 per maund.

In the manurial experiment the plots were arranged in duplicate. The manures used and the yields obtained during the last two years are shown in the following table. Cattle manure was used at 5.5 ton per acre, ground limestone at 823 pounds, bonemeal at 247 pounds and water hyacinth ash at 494 pounds.

Kakaya Bombay,	1918.	1919.	Average, in pound.
	1	2	3
Cowdung 150 maunds per acre	707	2,813	1,700
Cattle manure at 150 maunds per acre and bone meal at 3 maunds.	1,152	2,233	1,684
Cattle manure 150 maunds, and bone- meal at 3 maunds. Water Hyacinth at 6 maund per acre.	1,683	2,949	2,315
Cattle manure at 150 maunds, bonemeal at 3 maunds, water Hyacinth ash at 6 maunds and limestone at 10 maunds per acre.	Nil	3,098	3,098

Bonemeal costs at Rs. 3-8-0 per maund, Hyacinth ash Rs. 2-2-0 per maund, crushed limestone Re. 1-1-0 per maund.

The experiment will be continued during the coming season with the addition of two plots of water Hyacinth ash alone.

It is occasionally objected that the spread of jute growing is likely to reduce the area available for paddy. Double cropping with jute and paddy. To test whether jute and paddy can be profitably grown on the same land, a small experiment was carried out in 1918 and gave the following results.

The jute gave an outturn of 984 pounds of fibre per acre and the paddy 1,774 lbs. the total produce being valued at Rs. 153-12-0. The experiment will be repeated during the coming season on a larger scale.

A small area of both varieties of jute was kept for seed, the yield being 309 pounds per acre from the Habiganj variety as compared with slightly over 326 pounds from the Kakaya Bombai variety.

9. *Jowar* was again tried as a fodder crop for the rains, but Miscellaneous *Jowar* as fodder in the rains. the crop was practically a total failure as before. -I am afraid the farm is too low for *jowar*.

Improved varieties of sugarcane from the Mauritius were grown on a small scale. Jorhat Farm.

The farm lands are situated at too low a level for the successful growth of sugarcane on a large scale, but a small area is grown with the object of giving the farm apprentices a knowledge of the cultivation of sugarcane and of the making of *gur*.

10. As the price of the various pulses are steadily rising, experiments with various seeds of *rabi* crop Cold-weather crops. were laid down with a view to testing their suitability and subsequent introduction in the district. On account of the heavy rains in November during the sowing season and again in February and March during the harvesting season, most of the crops were total or partial failures.

Pulses should, however, be a profitable crop during a normal season.

Potato.—A few varieties of Shillong potatoes were tried against a local variety and though planted late, gave the following results.

Results of potatoes :—

			Yield per acre.
King of potatoes (large)	...	...	5,022 lbs.
Ditto (small)	...	...	2,204 lbs.
Windsor Castle	...	...	5,156 lbs.
Up-to-date	...	...	2,993 lbs.
Imperator	...	...	2,424 lbs.
Local	...	...	1,445 lbs.

Oats gave an outturn of 478 lbs. per acre although germination was rather thin.

11. A large area of non-experimental rice was grown during Non-experimental the year. Together with the experimental Crops, rice, it covered almost the entire area of the cultivated portion of the farm, the balance being occupied by small areas of sugarcane, jute and *dhainchā* which were grown for seed.

The total yield of the rice crop including the experimental plots was 1,089 maunds 6 seers 9 chhattak. In future the non-experimental area will be used mainly for the production of pure seed of recommended varieties.

Last year 229 maunds of Indra *sail* and 120 maunds George *sail* were obtained but a portion of these were not absolutely pure and could not be used for seed purposes. Special care is being taken that the seed produced in future on this Farm will be absolutely pure.

In block E the outturn of paddy from the different plots were harvested and weighed separately. This will be continued during the next two or three years. The difference in natural fertility of the plots will thus be determined and taken into account when experiments are laid out in these plots in the future.

12. No serious damage was caused to the Farm crops Insect pests. although different insect pests made their appearance at various times.

A lantern trap is giving very good results in checking the paddy stem-borers.

Ripersia Saccharai (scale insects) did some damage among the *asra* and *sail* paddy.

Receipts and expenditure for the Farm are shown below—

Receipts :—

	Rs. a. p.
Amount credited into treasury ...	5,850 13 3
Value of seeds supplied for Demonstration	412 2 0
" stock in hand (Jute Rs. 125, Jute seed Rs. 20, Gur Rs. 27, Paddy Rs. 231)	403 0 0
Bill outstanding	<u>5 11 0</u>
	6,671 10 3
Deduct value of Farm produce of previous year sold during the year ...	<u>3,440 1 0</u>
Nett Receipts ...	<u>3,231 9 3</u>

Expenditure :—

Capital—

Petty construction ...	... ...	1,800 0 0
Reclamation ...	... ...	100 0 0
		<u>1,900 0 0</u>

Recurring—

Establishment ...	... ...	2,911 15 3
Feed of cattle ...	... ...	299 14 4
Seeds, plants and manures and Implements ...	... ...	149 15 8
Wages of labourers ...	... ...	2,950 0 0
Petty repairs ...	... ...	1,024 6 8
Purchase and repair of furniture ...	... ...	63 7 0
Service postage and telegram charges ...	... ...	25 1 0
Unspecified charges ...	... ...	<u>459 0 6</u>

Total	7,883 12 0
-----------	---------	------------

Value of seed Potato supplied by the Seed Depot, Sylhet.	51 4 6
--	---------	--------

Grand total	<u>9,835 0 6</u>
-----------------	---------	------------------

The receipts were less than that of last year, mainly because the prices as well as the outturn of paddy was less than that of last year.

14 The sanctioned establishment of the farm
Staff. consists of :—

	Rs.
1 Farm Manager ...	... 100—5—200
1 Assistant Farm Manager ...	... 50—5—100
1 Farm clerk ...	... 25—1—8—40
1 Peon ...	... 8—0—0

The pay of the Assistant Farm Manager has been now raised to Rs. 50—5—100 and an experienced officer has been appointed to the post, the former Assistant reverting as Demonstrator. It is hoped that the Farm Manager will now be able to devote more personal attention to the experimental work.

As the selection work is expanding very rapidly a whole-time Botanical Assistant will soon be required.

The Farm Manager suffered from continued ill-health during the year. He had to be allowed privilege leave during October and November and again in February. The Farm clerk went on leave on the 1st April and subsequently resigned his post. The new clerk has been working since. The present Assistant Farm Manager took up his duties on the 4th December 1919.

There were thus considerable changes in the personnel of the staff, which caused considerable inconvenience in the work. The whole staff, however, worked with zeal and in spite of all the above difficulties the work done reflect credit to the whole staff, particularly on the Farm Manager who supervised the experimental work with his usual carefulness. There was frequent attacks of fever among the apprentices. Arrangements have now been made for the Karimganj Sub-Assistant Surgeon to visit the Farm twice a week.

Apprentices. One apprentice completed his training during the year and was appointed as a Demonstrator.

The apprentices on being appointed as Demonstrators experience considerable difficulties in realising their duties and accommodating themselves to the new conditions. One Demonstrator had to be dismissed during the last year and one during the previous year. To remedy this, senior apprentices are now being sent out to work with Agricultural Demonstrators with a view to their getting a practical knowledge of the work they will have to do. A candidate is also made to work on the Farm as an ordinary labourer for six months to one year, before he is appointed an apprentice.

As the successful working of the demonstrations depend very largely on the Demonstrators, great care is being paid to the selection and training of the apprentices and arrangements have been made to give them a more systematic training than before.

Eight apprentices are now under training, of which two are Hindus and the rest Mahammadans.

A Mahammadan apprentice intended for a scholarship at Sabour is also under practical training at the Farm. He has since been deputed to Sabour.

The farm was visited twice by the Director of Land Records and Agriculture, Assam, once by the Economic Botanist to the Government of Bengal and very frequently by myself. I am grateful to the Economic Botanist for his advice.

CAMP KARIMGANJ ;

J. N. CHAKRAVARTY,

The 20th April 1920.

*Offg. Deputy Director of Agriculture,
Surma Valley and Hill Districts.*

REPORT OF THE KAMRUP SUGARCANE EXPERIMENT STATION FOR THE YEAR ENDING THE 31ST MARCH 1920.

1. Introductory.—The objects and scope of this experiment were described in paragraph 1 of the annual report of the Kamrup Experiment station for the year ending 30th June 1914. As explained therein, it was proposed to reclaim an area of about a thousand acres of land for sugarcane cultivation, but up to the present it has been found possible to open out and keep under cultivation only about 800 acres, and without the aid of additional cultivating machinery, such as motor tractors with suitable implements, it is extremely doubtful whether the present area is capable of extension. The steam cultivating tackle is excellent for breaking up new land and preparing it for cane, but for other crops in the rotation some auxiliary implements are required for working up the finer tilth required for small seeds, and also for the ploughing in of green manure crops. Probably the addition of a disc plough and disc harrow to the steam tackle would go a long way to supply the deficiency, but owing to the fact that the work of planting cane and also the cultivation of land coming out of cane comes together with a rush in the spring, extra power in the form of motor tractors is required in order to get the spring cultivation done in due season, and also to enable us to get the full value of the existing steam tackle in extending the area under cultivation.

At the latter end of this year one Fordson motor tractor and two furrow Oliver plough were obtained, and a disc harrow have only just arrived. No new land was reclaimed during the year, so that the total area under cultivation remains 817 acres. Of this, 469 acres were under sugarcane (plant cane 239 acres and ratoon cane 230 acres), and the remainder under other crops.

The present report deals with the ratoons of the cane planted in 1918 and the plant cane crop planted up early in 1919, also with the preparation of the land for and the planting of the young crop for next year's harvest.

2. Land and communications.—The site of the experiment is situated in North Kamrup under the Bhutan Hills about 17 miles by road north of Nalbari station, Eastern Bengal Railway, and lies between the new and old Pagladiya rivers and near the

village of Topolia. The farm is approached from Nalbari station by a public road northward to Garbhitar village, some 10 miles, where a village track leading to Khagrabarigaon has been widened out and made into a cart road and extended to the present farm site which is 7 miles from Garbhitar. The greater portion of this tract consists of high land carrying tall grass jungle, with occasional swamps which are, however, capable of drainage, the fall from the hills to the south being from 15 to 20 feet per mile.

3. *Rainfall.*—Farm records have been kept since January 1915. The following table shows the figures for the year under report with monthly averages to date :—

Month.	Inches.	Average since January 1915.	
		1	2
April 1919	...	10.16	6.75
May "	...	13.71	15.21
June "	...	19.75	19.13
July "	...	8.89	21.11
August "	...	10.74	16.11
September "	...	20.13	11.06
October "	...	8.88	6.23
November "	...	0.35	0.30
December "	...	0.42	0.14
January 1920	...	0.00	0.15
February "	...	1.11	1.50
March "	...	12.66	2.85
Total	...	106.30	100.54

The main features of the past season were the extraordinary spring drought of January—March 1919, the total fall from January 1st, 1919—April 5th, 1919, being only 0.26 inches. This undoubtedly had a bad effect on germination of the 1919 cane, and is considered to have been responsible for the epidemic of beetles which wrought such devastation on the young crop in April.

Again during the months of September and October the total rainfall was much in excess of the average for these months.

The heavy rainfall from June to September once more largely prevented steam cultural operations with the result that only about half the green manure crops could be ploughed in with the implements at our disposal.

4. *Soil.*—The following report is by the Agricultural Chemist, Assam :—

Kamrup Farm Soils.

	Lab. No. 22.	Lab. No. 23.	Lab. No. 24.	Lab. No. 25.
	Block I. 0' 9".	Block I. 9' 15".	Block II. 0' 9".	Block IV. 0' 9".
1	2	3	4	5
A. Soluble in 26 per cent. Hydrochloric Acid with 48 hours' digestion at 100° C.	Per cent.	Per cent.	Per cent.	Per cent.
Phosphoric Acid (P_2O_5) ...	0.079	0.066	0.074	0.064
Potash (K_2O) ...	0.817	0.938	0.873	0.633
Lime (CaO) ...	0.273	0.210	0.168	0.108
Magnesia ($Mg O$) ...	0.864	0.955	0.869	0.73
B. Available, i.e., soluble in 1 per cent. Citric Acid with 7 days' digestion by Dyer's method—				
Phosphoric Acid ...	0.023	0.019	0.030	0.029
Potash	0.009	0.006	0.013	0.009
C. Moisture in air-dry soil ...	1.41	1.34	1.41	1.00
Loss on ignition (Organic matter and combined water).	4.62	3.08	4.79	3.33
Nitrogen	0.112	0.077	0.119	0.081

KAMBUP FARM SOILS—*concl'd.*

	Lab. No. 22.	Lab. No. 23.	Lab. No. 24.	Lab. No. 26.
	Block I. 0.9%.	Block I. 9.15%.	Block II. 0.9%.	Block IV. 0.9%.
1	2	3	4	5
	Per cent.	Per cent.	Per cent.	Per cent.
Humus	...	1.70	1.50	1.90
Reaction	...	Acid	Very slightly alkaline.	Acid
Lime (CaO) requirement per mil- lion of air-dry soil, in lbs., by Veitch's test.	460	nil	460	350
Carbonate of lime	...	0.017%	0.015%	0.012%
	0.015%			

Results are expressed as percentages on air-dry samples.

NOTES.—These soils present a striking similarity. Reserve Phosphoric Acid is on the weak side while the available amounts of that element of plant food are good.

Total Potash is high, more than would be expected in this class of soil at first sight. Available Potash is on the weak side in all except No. 24. Lime will probably bring the reserves into use.

Lime is low and Magnesia high.

Three out of four samples are acid in reaction.

Having regard to the low lime and high magnesia content, as also to the small amount of carbonate present, to the existing state of combination of the humus and to the reaction, I am of opinion that the primary requirement of these soils is lime, using preferably ground limestone. I anticipate a 25 per cent. increase in the cane crops as a result as a minimum.

Nitrogenous manuring for a crop like cane will be necessary and phosphatic manuring will have to be resorted to ere long.

More recent Laboratory work on these soils showed that the addition of carbonate of lime has a very pronounced effect on the soil biochemical processes, the rate of ammonification and subsequent nitrification being very greatly increased. While this should lead to increased crop yields, it implies of course an increased rate of turnover of the soil nitrogenous resources—both natural and added—and ultimately the same applies to other plant foods in the soil; therefore a sound crop rotation and adequate and suitable manuring which are important at any time become matters of greater moment when using limestone.

5. *Buildings, etc.*—The buildings consist of the Manager's bungalow, staff quarters, office with dispensary, coolie lines, cattle shed, godown, smithy, etc. These are all of a temporary type except the Manager's bungalow. During the year a large godown was erected with corrugated iron roof at a cost of Rs. 2,500. The cultivated area is enclosed by $4\frac{1}{2}$ miles of wire fencing. In spite of this bears as usual did a great deal of damage to the crops.

6. *Cattle.*—No new bullocks were purchased during the year. Five died, leaving 68 head of bullocks on the farm at present many of which are somewhat aged.

7. *Water-supply.*—Norton tube wells are used and give every satisfaction, an excellent supply of drinking water being available all the year round. These wells distributed over the cane area provide water also for the engines. In addition a permanent running stream close by the coolie lines supplies water for washing purposes, etc.

8. *Labour.*—As usual, labour was recruited from Ranchi personally by the Manager with the sanction of the Bihar and Orissa Government. The coolies are now recruited on a 12 months' basis. The labour force keeps good health on the whole, but spleen is prevalent among the children. No epidemics occurred during the year under report.

Local labour is casual and fluctuates widely ; nevertheless it assists at busy seasons. At the end of the year the total imported labour force amounted to 125 men, 164 women and 50 children. Local labour employed during the harvesting season consisted of 112 men, 94 women and 49 children.

9. *Cultivating tackle.*—This comprises :—

2 steam tractors, Fowler's compound engines ;
 1 five-furrow double ended plough ;
 1 harrow ;
 1 cultivator ;
 1 cambridge roller ;
 1 ridger ;
 1 leveller ;
 1 ditcher ;
 1 motor plough, Fowler-Wyllie.

also the following purchased during the year :—

	Rs.
1 Fordson tractor	4,250
1 Oliver plough for same	550
1 Disc Harrow "	475
Spare parts for steam tackle	8,319

The steam tackle has continued to work satisfactorily. The engines were thoroughly overhauled before the cold season's work commenced and are in very good condition.

The Fowler-Wyllie motor plough has so far proved quite useless here owing to its narrow wheel base, which causes it to topple over on uneven land.

10. *Drainage*.—The drainage system adopted in 1916 (see paragraph 11 of the report for that year), again worked well, but during the height of the rainy season there was evidence on certain areas that the cane was suffering from wet feet. It is my opinion that the drainage of most of the cane blocks though much improved is deficient still. In times of continuous heavy rain the water table rises too near the surface. It seems to me that this is a matter which can only be tackled thoroughly as a factor in an extensive scheme of operations, and it also appears likely that it will be necessary to go outside the actual cane grants in order to clear up and open out natural drainage channels, the present choked condition of which holds the water up and keeps the water table undesirably high in the rains, leading to conditions which largely prohibit the use of the steam cultivating tackle from June to October and rendered even decent cultivation by hand impossible in some areas. No new main channels were cut, but the whole of the existing drains were drained out and deepened a foot.

11. *Sugarcane crop of 1919-20*.—This consisted of 230 acres of ratoons of the previous year's plant cane crop, the results of which appeared in last year's report, and 239 acres of plant cane, planted up early in 1919.

The distribution was as follows :—

Ratoon.		Plant cane.	
	Acre.		Acre.
Block No. 11	48	Block No. 1	60
" 12	16	" 2	55
" 13	60	" 3	60
" 15	25	" 5	30
" 16	15	" 14	34
" 17	54		
" 18	12		
Total	... 230	Total	... 239

As briefly noticed at the close of the last year's report, the farm was visited by a very destructive beetle, which appeared in epidemic form in April and did an enormous amount of damage to the young plant cane and ratoons in a very short time. It worked underground eating off the growing shoots and eye buds at the base. It was also found boring in the setts of plant cane and in the stumps of ratoons. Coming as it did upon the top of a germination which from drought and other causes was initially none too good, this epidemic of beetles wrought serious havoc on the young crop. Within a few days very extensive damage was apparent in the withered shoots all over the farm, the ratoons suffering more than the plant canes.

The beetles appear to have originated in the grass jungle round about the farm, being found on examination in the roots of wild grasses and canes every where. It is the beetle itself, and not its grub, which is responsible for the active damage; in this respect our case differs from similar outbreaks reported from Australia, where apparently the grub, and not the beetle, is the destructive agent. As a result of the attack large areas of cane on certain blocks were practically wiped out; in consequence the whole of block 15 with parts of blocks 11, 13, 16 and 17 were abandoned. It was calculated that some 70 per cent. of the area under ratoons and about 50 per cent. of that under plant cane was irrevocably ruined.

In effect then the young crop was largely wiped out and though in places a new crop of young shoots was produced, this was so late in the season that the canes had not time to mature properly. The crop at harvest time was thus a very short one indeed.

The Imperial Entomologist, Pusa, who is working out the life history of this beetle, assured us that the epidemic was probably conditioned by the long continued spring drought and that its recurrence was improbable.

Immediately the beetles were reported an Assistant of the Imperial Entomologist was sent down to the farm along with the local Entomological Assistant. A thorough study was made of the epidemic in regard to the incidence of attack and extent of the damage all over the farm. Specimens were collected for further observation and work on the life history of the pest, and a report was duly submitted by the Imperial Entomologist to the Local Administration in which some 20 per cent. of the total damage was credited to the beetles and the rest to drought and other causes.

The following further report has just come to hand from the Imperial Entomologist :—

"The subsequent behaviour in the Pusa Insectary of the beetles collected in the Kamrup Farm in May 1919, corroborated what was stated in Mr. Ghosh's report with regard to their habits. *Aissonotum impressicollis*, by far the commonest and the real culprit of the three species, rested in the Insectary under earth without taking any food till October 1919 when egg laying commenced. There were 54 beetles of this species alive in October and they gradually died out by the middle of December 1919. Three hundred and twenty-seven eggs were obtained from them in October and November. The eggs hatched in 15 to 20 days and the grubs fed on maize roots and farmyard manure. At the time of writing this note (21st March 1920) some of the grubs appear to be full grown and are expected to pupate and attain the adult stage soon. The pest has thus only one generation in the year. Under natural conditions in the fields and grass lands in Kamrup the periods of egg laying and the dates of pupation and emergence of the adults may be slightly different and probably more distributed throughout the hot weather.

Some of the beetles belonging to the second species, viz., *Aissonotum piceum*, similarly rested and the last of them died by the middle of December 1919. No eggs were obtained from them.

Of *Heteronichus sublaevis* there was only one live specimen with which the work was started in May 1919, and it died some time before October 1919."

On account of the cane crop being so sparse and unable to mother them, annual weeds gave a great deal of trouble. More than the usual cultivation was given during the season, but it was impossible to keep pace with the jungle. The cane was stripped early in the cold weather.

As regards manuring, no manure was applied to the ratoon crop.

The following manuring was given to the plant cane :—

Block 1 30 acres had 20 maunds oilcake per acre.

 " 30 " 10 " " "

 " 2 20 maunds oilcake manure all over.

Blocks 3 and 5 7½ maunds oilcake manure all over.

Harvesting for planting the new crop commenced on February

16th, 1920, though the Factory did not commence work till the middle of March. In consequence in the meantime the bottom of canes cut for planting had to be thrown away.

The Factory worked from March 15th to mid April, the total amount of cane supplied to the Factory up to the 10th April being some 1,157·5 tons.

12. *Outturn of cane.*—For reasons explained previously the crop all over was a very short one. Parts of blocks Nos. 17 and 18 escaped beetle attack for some reason, and here the crop of ratoon Striped Mauritius was very good; my estimate was 15·29 tons per acre in parts of these two blocks. Harvesting of these two numbers is not yet finished however.

In regard to the rest of the cane blocks, owing to the removal of canes for planting and other causes, a reliable estimate of cane yield is only possible in the case of blocks Nos. 1, 2 and 12 for which the following figures were obtained :—

Block No.	Variety.	Area of block.	Weight of cane stripped for milling.	Weight of cane per acre.
1	2	3	4	5
1	B-376, plant cane	... ...	60	292·65
2	B-147, ,	... ...	55	345·2
12	B-376, ratoons	... ...	16	103·74

13. *Quality of cane.*—The same scheme of analytical control of the factory milling as was adopted in previous years was again carried through.

The results for the various blocks are given in Table I.

The average percentage of sucrose in the canes was rather higher this year than last, working out at 13·73 per cent. The figures for the mixed varieties are lower than they should be owing to the fact that they included some admixture of cane which had been lying out uncollected in the fields for many days after harvest.

FAMILI.

14. Cane Nurseries. Trial of new Varieties. Ratoons.—The plant cane varieties described in paragraph 14 of last year's report were ratooned. They were harvested and analysed when 12 to 13 months old and the results appear in Table II.

It will be seen that certain varieties give high figures for sucrose on cane; these figures would be somewhat lower on the field scale. B-208 in spite of its high quality would not appear to be suitable for this tract. It is far too soft and open to bore attack leading to subsequent disease. The figures show that practically all the varieties ripen off their juice much better than they do further north at Jorhat.

Plant cane.—Most of the varieties were again planted out in January 1919 in block No. 14, about 2 acres of each being planted. Many of these varieties behaved very well in the field, but all were, more or less, damaged by beetle attack. It was hoped to get figures for crop outturn from these plots, but on account of the demand for planting material and other causes it proved impossible this year. The varieties were, however, analysed, about 400 lbs. of cane being taken in each case. The results appear in Table III. The figures for sucrose on cane are good on the whole, the best being B-6150 Red Mauritius, Java Red, and W. M. No. 3. Practically all have again this year (1920) been planted out on a still larger scale in Block No. 6, and with good cultivation some of them should make a very good showing, and comparative crop weightments should be possible early in 1921.

TABLE II.—NURSERY CANKS, 1919-1920. RAYMOND.

Variety.	Date of milling.	Infected, per cent.	Survived in juice, per cent.	Survived in bagasse, per cent.	Purity coefficient, per cent.	Survive in cane, per cent.	Remarks.
1	2	3	4	5	6	7	8
Red Java	... 6th February 1920 ...	70·4	17·9	8·61	92·5	15·5	These tests were made on quantities of can averaging about 200 lbs. in each case. The figures for 'n rose content are therefore probably a little higher than would obtain on a field scale.
B. 208	... 7th " " ...	68·7	19·86	9·22	90·6	16·53	
Red Mauritius	... 9th " " ...	70·9	17·33	8·53	95·2	14·78	
J. 332	... 10th " " ...	69·1	15·19	7·28	90·4	12·74	
Tana	... 11th " " ...	68·1	14·75	7·12	88·6	12·31	The canes were 12½ months old at time of harvest.
B. 6450	... 12th " " ...	72·9	19·95	7·48	91·4	16·57	
B. 3412	... 13th " " ...	71·0	14·37	6·62	89·3	12·13	
Barbadoes A	... 14th " " ...	70·7	15·29	6·54	88·6	12·82	
W. M. No. 3	... 16th " " ...	65·6	18·66	10·5	94·2	15·86	
J. 247	... 17th " " ...	69·6	17·63	8·2	93·3	14·69	

TABLE III.—VARIETIES EX. BLOCK 14, 1919-1920. PLANT CANE.

Variety,	Date of milling,	Juice express. After trial.	Sucrose in juice, per cent.	Purity coeff. Brixess., per cent.	Sucrose in cane, per cent.	Remarks.	
1	2	3	4	5	6	7	8
Red Mauritius	18th February 1920 ...	70·1	16·91	8·04	93·2	14·26	Three canes were practically 13 months old at time of harvest.
J. 33a	19th	67·3	15·59	7·20	87·1	12·85	The average weight of cane taken was about 400 lbs. in each case.
B. 6150	20th	72·6	18·78	8·27	94·5	15·96	On a field scale the figures for sucrose would come out rather lower.
White Bombay	21st	73·2	15·77	7·00	83·4	13·43	
Barbadoes A	23rd	69·7	16·47	6·94	92·9	13·58	
W. M. No. 2	24th	65·9	17·15	8·24	91·0	14·11	
B. 3412	25th	70·4	15·61	6·70	91·6	12·97	
J. 247	26th	67·0	16·43	5·64	88·6	12·20	
Java Green	27th	71·7	16·25	7·56	90·6	13·79	
Java Red	28th	69·1	17·61	9·52	91·5	15·12	
Texas	1st March	66·6	14·82	6·20	85·7	11·44	

15. *Planting and manuring of the present crop, 1920-21.*— Planting commenced in the middle of February and was completed by the end of March 1920. We cannot this year at any rate complain of lack of rain for germination. February recorded 111 inches of rain, and about 9 inches fell in the first half of March.

The following shows details of areas planted :—

Block No.	Area, acres.	Varieties of cane.	Date of planting.	Remarks.
1	2	3	4	5
5 (Four year ro- tation).	60	S. Mauritius ...	March 3rd to 26th.	1915—Land broken up. 1916—Plant cane. 1917—Ratoon ” 1918—Green manure. 1919— ” ”
6 (Three year ro- tation).	50	Varieties ex- Nurseries.	March 2nd to 28th.	1915-1916—Broken up. 1916—Green manure. 1917—Plant cane. 1918—Ratoon ” 1919—Green manure.
8 (Three year ro- tation).	60	B. 376 ...	February 24th to 28th.	1916—Broken up. 1917—Plant cane. 1918—Ratoon ” 1919—Green manure.
9 (Two year ro- tation).	55	B. 147 ...	February 16th to 23rd.	1916—Broken up. 1917—Plant cane. 1918—Ratoon ” 1919—Green manure.

In the case of Blocks Nos. 4 and 9 the previous green manure crop of Dhaincha in 1919 was ploughed in.

On Blocks 6 and 8 the *dhaincha* could not be ploughed in unfortunately ; it was cut and burnt off later.

The Plant cane crop of 1919 is being ratooned this year, vacancies resulting from various causes being infilled so far as possible. Thus the total area under cane in 1920 is 434 acres, of which 209 acres is ratoons and 225 acres plant cane.

The following scheme shows briefly the manuring programme for 1920.

Manuring Scheme, Kamrup Farm, 1920.

Block No.	Cane.	Manuring.	Quantity per acre.	Supplying per acre.
1	2	3	4	5
1, 2 & 3	Ratoons ...	Animal meal ..	10 maunds	60 lbs. Nitrogen. 60 lbs. Phosphoric Acid.
14	" "	" "	5 maunds	30 lbs. Nitrogen. 30 lbs. Phosphoric Acid.
6	Plant ...	Fish guano ..	10 maunds	60 lbs. Nitrogen. 75 lbs. Phosphoric Acid.
9	" "	Ground nut cake ..	10 maunds	60 lbs. Nitrogen.
8	" "	Animal meal ..	10 maunds	60 lbs. Nitrogen. • 60 lbs. Phosphoric Acid.
4	"	Various forms of Nitrogen, e.g., in oil-cakes, Fish guano, animal meal, Nitrolim, Sulphate of Ammonia, Nitrate of Soda on limed areas versus unlimed areas, and again on both areas with and without Phosphoric acid applied as Basic slag or Superphosphate.	...	Nitrogen 60 lbs. Phosphoric acid 40 lbs. Lime applied on the limed area to supply the soil's maximum requirements to plough depth, i.e., 9 inches.

N. B.—For details of Block 4, Manurial Experiment, see plan in appendix to this report.

In regard to the application of the manures the general scheme was to apply lime, Basic slag and Superphosphate previous to planting. Of the other manures for plant cane all except Sulphate of Ammonia and Nitrate of Soda were to be applied half before planting and half later at first earthing up.

The pre-planting programme was carried out completely with the exception of Cyanamide which arriving too late must now be applied as a top dressing in common with the Sulphate of Ammonia and Nitrate of Soda.

As regards ratoon manuring, the whole of the manure is to be applied in one dressing, which should be given a few weeks after hoeing up the plant cane stubbles and when the young ratoon crop has broken away nicely.

16. *Other crops.*—*Dhaincha* (*Sesbania aculeata*) was grown for seed on 25 acres of No. 5, and the yield of seed was $107\frac{1}{2}$ maunds.

Jute.—Mr. Finlow's "Kakya" *Bombai* was grown for seed on 5 acres of No. 5, the crop was $44\frac{3}{4}$ maunds cleaned seed, which was an excellent result.

Green Manure Crops.—*Dhaincha* for green manure was sown in Blocks Nos. 4, 6, 7, 8, 9 and 10. It made fine crops. Unfortunately only on Blocks Nos. 4, 9 and 10 was it possible to plough the crop in green. On Nos. 6, 7 and 8 the crop was cut and burnt off later on.

Thus in a year when the rainfall of the early part of the season was comparatively short it was only found possible to plough in about 50 per cent. of the green manure crops with the implements at our disposal. The possession of a disc harrow and plough for the steam tackle would help by enabling other green crops to be handled, and these implements are very much needed on the farm.

Rabi crops.—It was intended to sow rape on certain blocks as a cold weather crop.

The late rains in October delayed preparation of the land so long that we came to the conclusion it was far too late for sowing by the time the land was ready.

17. *Spring sowings.*—Land not under cane in 1920 is being sown during the rains as follows:—

Blocks Nos. 5, 7, 10, 11, 12, 13, 15, 16, 17, and 18, *dhaincha* for green manure.

Some *dhaincha* for seed will also be put down.

18. *Expenditure.*—

ESTABLISHMENT.—

			Rs.	a.	p.
Manager	...	...	12,000	0	0
Assistant Manager	...	...	1,100	0	0
Clerk	...	...	625	0	0
Mubarrir	...	...	540	0	0
Compounder	...	...	330	0	0
Peons	...	...	310	0	0
Tackle Assistants	...	...	2,772	0	0
Sugar analyst	...	...	200	0	0
Total	...	...	17,877	0	0

SPECIAL CONTINGENCIES —			Rs.	a.	p.
Implements, Machinery, etc.	...	...	9,161	10	0
Petty Construction	...	...	2,439	2	2
Books, etc.	...	...	5	5	0
Total	...	...	11,666	1	2
<hr/>					
REGULAR CONTINGENCIES —					
Feed of cattle	...	...	3,893	11	0
Seeds, plants and manures	...	...	10,583	12	9
Wages of labourers...	...	...	51,925	11	3
Petty repairs	...	...	8,178	4	4
Furniture	...	...	92	0	0
Postage charges	...	...	50	0	0
Unspecified charges	...	...	1,830	0	0
Fuel	...	...	9,278	2	0
Stores, oil, etc.	...	...	912	13	0
Total	...	...	81,742	6	4
Grand total	...	...	111,285	7	6

The actual amount credited into the treasury during the year was Rs. 6,912-10-3.

19. *Staff*.—This consisted of :—

			Rs.
1 Manager	...	...	1,600
1 Assistant Manager	...	...	100
1 Clerk	...	...	50
1 Muharrir	...	...	25
1 Do.	...	...	20
1 Compounder	...	...	30
1 Head Mistry	...	...	55
1 Fitter	...	...	35
2 Engine men	...	...	25
2 Do.	...	...	20
2 Do.	...	...	18
1 Engine man	...	...	15
2 Peons	...	...	10

20. *General.*—The Indian Sugar Committee, with the Agricultural Adviser to the Government of India as Chairman, visited the Farm on January 5th and 6th, 1920, for the purposes of inspecting the Farm and also the Factory of Messrs. Bird & Co., and to take evidence.

Other visitors during the year included the Deputy Commissioner, Kamrup, Deputy Conservator of Forests, the Sanitary Commissioner, the Director of Public Instruction, the Superintendent Civil Veterinary Department, the Imperial Agriculturist and Secretary of the Indian Sugar Bureau, and Sreejut Debeswar Goswami, etc.

A. A. MEGGITT,

Agriontural Chemist, Assam.

NOTE—The Kamrup Farm was transferred to the Assam Sugar Estates and Factories Ltd. (Messrs. Bird & Co., Managing Agents), on 1st April 1920.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN
THE ASSAM VALLEY CIRCLE, INCLUDING THE
GARO HILLS AND THE SADIYA FRONTIER TRACT,
FOR THE YEAR ENDING THE 31st MARCH 1920.

Staff.—The year under review saw a good deal of change in the demonstration staff in the Assam Valley. Srijut Laksheswar Barthakur, the Superintendent of Agriculture, Assam Valley, being appointed to officiate as Deputy Director of Agriculture, Assam Valley, Babu Satyendra Chandra Dutta, the Agricultural Inspector, Kamrup, was promoted to act in his place, while Babu Pulin Behari Ghose, a new probationer, was given the charge of the Agricultural Inspector of Kamrup. The appointment of Srijut Golok Chandra Bora, the late Agricultural Inspector of Nowgong, as Sericultural Superintendent in the Department of Industries caused another vacancy in the early part of the year and to fill up his place Srijut Mohichandra Gogoi had to be transferred from Lakhimpur to Nowgong, leaving the former place without an Inspector. Towards the end of the year two demonstrators were newly appointed and posted in the districts of Nowgong and Goalpara. Thus the demonstration staff in the Valley now consists of one Superintendent of Agriculture, four Inspectors and 15 Demonstrators—fourteen in the plains and one in the Garo Hills, besides one Instructor and two Naga demonstrators in the Sadiya Frontier Tract.

Srijut Laksheswar Barthakur held the post of the Superintendent of Agriculture, Assam Valley, till the 20th June 1919, and was on tour for 35 days. Babu Satyendra Chandra Dutta, Agricultural Inspector, Kamrup, took up the duties of the Superintendent from the 21st June and remained in charge throughout. He was on tour for 176 days, of which 30 were spent outside his jurisdiction in visiting Karimganj, Nagpur and Calcutta.

While in the post of Agricultural Inspector, Kamrup, Babu Satyendra Chandra Dutta was on tour for 46 days. Babu Pulin Behari Ghose was appointed a probationary Agricultural Inspector on the 29th June and put under training for six months with the Superintendent of Agriculture. Since his appointment Pulin Babu has been doing the duties of Agricultural Inspector of Kamrup and was on tour for 174 days. To assist the Agricultural Inspector there were 3 demonstrators, their headquarters being at Gauhati, Palasbari and Nalbari.

Srijut Golok Chandra Bora held the charge of demonstration work in Nowgong till the 22nd July 1919, when he was transferred to the department of Industries and Srijut Mohichandra Gogoi was transferred from Lakhimpur and placed in charge. The former was on tour for 57 days and the latter for 201 days as Agricultural Inspector, Nowgong. There were two demonstrators throughout the year headquartered at Kampur and Nowgong and one more was appointed towards the end of the year and posted at Samoguri.

Srijut Debiprosad Gohain continued in the post of Agricultural Inspector of Sibsagar and was on tour for 233 days. He was assisted throughout the year by three demonstrators posted at Jorhat, Golaghat and Sibsagar. To cope with the increasing work an additional demonstrator was posted at Jorhat during the year.

The district of Lakhimpur which had been brought into the scheme of demonstration work in July 1919 had to be practically closed with the transfer of Srijut Mohichandra Gogoi to Nowgong. Of the two demonstrators one was removed to Jorhat and the other is still working with headquarters at Dibrugarh.

Srijut Lalit Mohon Das was in charge of the demonstration work in the Goalpara district. He was on tour for 191 days. He was assisted by two demonstrators, headquartered at Dhubri and Abhayapuri from the beginning of the year and towards its close another was newly appointed and posted at Bilasipara.

The post of Agricultural Instructor, Sadiya Frontier Tract, continued to be held by Mr. M. Smith. The Agricultural Instructor worked under the orders of the Political Officer at Sadiya. There were also two Angami Naga demonstrators to assist him in teaching terrace cultivation to the Abors.

In the Garo Hills, demonstrations are being carried on by a Garo Demonstrator, H. Momin, who worked under the control of the Agricultural Inspector, Goalpara.

2. *Demonstration work in the Assam Valley.*—This was continued on similar lines as in previous years.

The following were the main items of demonstrations:—

- (1) *Rice*.—Manuring and variety trials.
- (2) *Sugar cane*.—Demonstration with superior variety, and the use of the three-roller iron sugar mill and the shallow *gur* boiling pan.
- (3) *Potatoes*.—Demonstration with superior variety from Shillong.
- (4) *Jute*.—Introduction of Finlow's "Kakiya Bombai" jute.

- (5) Introduction of miscellaneous crops, including pulses and fodder.
 (6) Conservation of cattle manure in covered pits.
 (7) Meston Ploughs.

3. *Residual effect of manures in the third year.*—These demonstrations were commenced in Kamrup and Sibsagar in 1917. The phosphatic manures were applied at the rate of 3 mls. and oil-cake 6 mds. per acre. The cost of manures per acre was Rs. 9 for bone-meal and Rs. 10.8 for flour of phosphate as well as for oil-cake. The cost of green-manuring with *dhaani* was about Rs. 2 per acre.

THIRD YEAR'S RESULTS.

Field of grain per acre, in pounds.

District and centre.	Check or no manure plot.		Bone-meal plot.	Flour of phosphate plot.	Flour of phosphate and dhaani green manuring plot.	Bone-meal and dhaani manuring plot.	<i>Dhaincha</i> green manuring plot.	<i>Dhaincha</i> green manure plot.	Oil-cake plot.	Remarks.
	1	2								
Sibsagar: Korsapur	...	...	...	...	...	...	...	...	...
Betiani	803	1,463	1,730	1,831	1,608	1,730	...	...	...
Sukandibukuri	1,360	1,460	1,461	1,457	1,457	1,427	...	...	...
Kakojan	1,643	2,051	1,573	1,440	1,515	1,624	...	...	...
Total increase in the first year.	...	337	154	251	198	203	...	...	...	Abandoned by the cultivator.
Total increase in the second year.	...	343	301	311	340	-41	...	...	...
Total increase in the third year.	...	883	1,003	723	670	818	...	...	...
Total increase	...	1,632	1,417	1,284	1,400	535	...	...	...
Sibsagar: Halikapat	...	...	...	...	...	...	...	...	...	Abandoned by the cultivator.
Jahukarai	1,530	1,580	...	...	...	...	...	...	...
Deolongeswar	1,803	1,977	...	...	...	...	...	...	...
Nopomsa	1,626	...	1,536	...	...	...	...	...	...
Amolapuri	1,066	...	1,426	...	...	...	...	...	...
Total increase in the first year.	...	103	315	...	...	...	...	...	...
Total increase in the second year.	...	280	252	...	...	...	...	...	...
Total increase in the third year.	...	242	220	...	...	...	...	...	...
Total increase	...	723	597	...	...	...	...	...	...

THIRD YEAR'S RESULTS—concl'd.
Yield of grain per acre in pounds—concl'd.

District and centre.	Check or no manure plot.	Bone-meal plot.	Flour of phosphate plot.	Flour of phosphate and dhaincha grass manuring plot.	Bone-meal and dhaincha green-manuring plot.	Dhaincha green-manure plot.	Oil-seed plot.	Remarks.
1	2	3	4	5	6	7	8	9
Kamrup : Sandhlei ..	...	...	...	...	...	...	...
Dharmotola ..	915	...	...	...	1,000	644	...	Failure of crop due to drought. Ahu.
Neragaon ..	1,780	...	...	...	1,874	1,098	...	Ahu.
Rangamati ..	1,975	...	...	...	1,740	1,022	...	Sali.
Saypara ..	1,645	...	...	...	2,350	1,799	...	Sali.
Average increase in the third year.	...	...	...	...	239	9	...	
Previous increase in the second year.	...	...	...	...	404	246	...	
Previous increase in the first year.	...	...	...	...	414	183	...	
Total increase ..	...	...	...	...	1,077	435	...	

In the first series of demonstration in the Sibsagar district the value of bone-meal, flour of phosphate, green-manuring with *dhaincha* and green-manuring in conjunction with the phosphatic manures were compared. In the cultivators' fields results of scientific accuracy are out of question and the conditions under which those demonstrations are carried on, are not all that is desirable. But on the whole they go a great way to show how paying it is to manure. The following table gives a comparison of the cost of the different kinds of manuring and their profits on the increase of the three years taken together, paddy being valued at Rs. 3 per maund.

—	Bone-meal.	Flour of phosphate	Flour of phosphate and <i>dhaincha</i> .	Bone-meal and <i>Dhaincha</i> .	<i>Dhaincha</i> .
1	2	3	4	5	6
Cost of manuring ..	Rs. a. 9	Rs. a. 10-8	Rs. a. 12-8	Rs. a. 11-0	Rs. a. 2-1
Value of increase per acre ..	56-8	52-8	4-8	52-2	20-0
Profit per acre ..	47-8	2-0	36-0	41-0	18-0

In the Second series carried out in Sibsagar bone-meal and flour of phosphate were tried, the former gave an average profit of Rs. 26.8 per acre over the three years as compared with Rs. 29.8 from flour of phosphate.

In Kamrup the five demonstrations of *dhaincha* green manuring and *dhaincha* plus bone-meal were kept under observation in their third year but in one centre, Sandheli, the crop failed owing to drought and the remaining four gave an average outturn of 253 pounds from *dhaincha* with bone-meal and only 9 pounds from *dhaincha* alone. Taking the aggregated results of three years green manuring with *dhaincha* shows a nett profit of Rs. 16 per acre and that in conjunction with bone-meal Rs. 40 per acre.

At Parakuchi in Kamrup one plot which had received bone-meal at the rate of 3 maunds per acre in 1914 was redressed with the same dose of bone-meal in 1917 and kept under observation. It gave an increase of 639 pounds per acre in 1919 over the non-manured plot. The previous increases in 1917 and 1918 being 619 lbs. and 563 lbs. respectively, the total increase over the three years came up to 1821 lbs. and the nett profit of applying bone-meal to Rs. 67 per acre.

4. Residual effect of manures in the second year.—In 1918 manurial demonstrations with bone-meal and flour of phosphate were continued in three centres in Sibsagar and with green manure, oil-cake and *dhaincha* with bone-meal in seven centres in Kamrup and kept under observation during the year under report. The second year's results together with the averages of the first year's outturn are given below. In Sibsagar demonstrations it is difficult to explain how the increases due to bone-meal and flour of phosphate obtained in the first year could swell seven times in the second year. The result of oil-cake in Kamrup are very striking and arrangements are being made to try it on a large scale in the coming season in the localities where there were such good results. The rates of application of these manures were the same as in previous years and their cost per maund was Rs. 3.4 for bone-meal, Rs. 3.10 for flour of phosphate, Re. 1.8 for oil-cake. These demonstrations will be continued under observation for another year.

SECOND YEAR'S RESULTS.

Outturn in pounds of grain per acre.

District and centre.	Check or no manure plot.	Bone-meal plot.	Plots of phosphate	Plots of Phosphate and diammonium green manure plots.	Bone-meal with dia-mine chis green-manure plots.	Dhaincha plot.	Oil-cake plot.	Remarks.
1	2	3	4	5	6	7	8	9
SIBSAGAR.								
Dergaon	454	1,052	1,306	1,355	1,524	993	...	First year's results were not recorded.
Jogigaon	1,117	1,710	...	...	...	...	...
Bochapathar	1,058	1,512	...	...	...	...	...
Rupkalia	1,310	...	2,168	...	...	...	...
Average increase in the second year,	...	523	858	...	...	...	...
Previous increase in the first year.	...	69	113	...	...	...	...
Total increase in two years.	...	552	1,001	...	...	...	...
KAMRUP.								
Nailari	347	...	...	...	*	462	...	*Crop on the bone-meal and green-manure plot failed on account of drought.
Agdala	547	...	...	...	1,029	1,089	...	
Dounichaki	1,042	...	...	...	1,186	1,140	...	
Dokhola	1,016	...	...	...	102	1,016	...	
Upcharali	2,287	...	...	...	...	...	2,666	
Suradih	1,640	...	...	...	...	...	1,742	
Satpar	785	...	...	...	...	...	863	
Average increase	...	...	...	...	100	118	154	
Previous increase in the first year.	...	...	...	...	248	147	856	
Total increase in two years.	...	...	...	...	348	200	650	

5. *New Manurial Demonstrations on Rice.*—A large number of new paddy manurial demonstrations have been started in 1919 in all the districts under the activities of the department. Their results are shown in the table below. Manures were applied at the same rate as in previous years, viz., bone-meal and flour of phosphate at three maunds per acre, and oil-cake 6 maunds per acre and their relative cost was Rs. 4, Rs. 4 and Rs. 2 per acre. Except oil-cake and *dhaincha* green manure, all the rest will continue to show effect at least for three years and their economic value will be better judged at the end of the third year. Oil-cake has given an average increase of 236 lbs. per acre in Sibsagar and 139 lbs. per acre in Kamrup while green manuring with *dhaincha* produced on the average 173 lbs. per acre in Sibsagar, 317 lbs. per acre in Kamrup and 791 lbs. per acre in Nowgong in excess over the average outturn of the check plots. Valuing paddy at Rs. 3-8 per maund the average increase from the *dhaincha* green-manure leaves a profit of Rs. 5 8, Rs. 11-8 and Rs. 32 in Sibsagar, Kamrup and Nowgong respectively, while in the case of oil-cake the value of the first year's increase alone was not sufficient to pay for the application of the manure.

NEW RICE MANURIAL DEMONSTRATIONS.

Grain in pound per acre.

	Check or no manure plot.	Bone-meal plot.	Flour of phosphate plot.	Flour of phosphate and <i>dhaincha</i> green-manure plot.	Bone-meal and <i>dhaincha</i> green-manure plot.	<i>Dhaincha</i> green-manure plot.	Oil-cake plot.	Remarks.
1	2	3	4	5	6	7	8	
SIBSAGAR.								
Kilugon	...	1,856	2,117	...	...	...	...
Egerijeng	...	2,240	1,630	...	...	...	...
Southola	...	8,808	9,825	...	...	...	...
Bettani	...	1,410	1,794	...	...	...	...
Kamarbandha	...	1,173	1,280	...	...	...	...
Kalatigaon	...	1,263	1,610	...	...	...	...

NEW RICE MANURIAL DEMONSTRATIONS—*contd.**Grain in pounds per acre—*contd.**

	Check or no manure plot.	Bone-meal.	Fertil. of phosphate plot.	Fertil. of phosphate and dhaincha green-manure plot.	Bone-meal and dhaincha green-manure plot.	Dhaincha green-manure plot.	Oil-cake plot.	Remarks.
1	2	3	4	5	6	7	8	
SIBSAGAR— <i>contd.</i>								
Jalukgaon	... 959	1,416	...	...	...	...	...
Hatigar	... 748	1,116	...	...	...	...	...
Chengeligaon	... 1,482	...	1,783	...	...	...	...
Bagorijeng	... 750	...	1,501	...	...	...	...
Dhai Ali	... 1,085	...	...	1,601	1,618	...	...
Bengenakhoa	... 536	...	...	1,407	...	709	...	
Dhai Ali	... 1,305	...	...	...	...	...	1,697	
Kalugaon	... 1,177	...	...	...	...	...	1,257	
Average increase	... ...	189	526	693	533	173	336	
KAMRUP.								
Sitalpur	... 1,239	...	...	...	1,701	1,671	...	
Toagra (Beltola)	... 533	...	...	...	1,059	1,028	...	
Kollapsa (Beltola)	... 1,004	...	...	...	1,289	1,069	...	
Rangia	... 1,633	...	...	...	...	...	1,724	
Doula	... 1,996	...	...	...	...	...	2,292	<i>Salti; oil-cake was applied after she was harvested.</i>
Dehali	... 1,309	...	...	...	...	...	1,489	<i>Salti.</i>
Average increase	... ...	...	...	...	404	317	159	

NEW RICE MANURIAL DEMONSTRATIONS—concl'd.

Grain in pounds per acre—concl'd.

	Check or no manure plot.	Bone-meal plot.	Fertil of phosphate plot.	Fertil of phosphate and chemical green-nature plot.	Bone-meal and diamine green manure plot.	Diamine green manure plot.	Olive-leaf plot.	Remarks.
1	2	3	4	5	6	7	8	
NOWGONG.								
Tetelisora ...	1,270	1,573	...	...	1,634	1,483	...	
Paranigudam ...	1,247	1,752	...	...	1,590	2,072	...	
Kumargaoen ...	1,936	2,783	...	...	...	...	...
Kothistoli ...	2,390	2,248	...	...	...	...	...
West Nowgong ...	1,411	1,663	...	...	...	...	...
Gomethagaoen ...	943	1,210	...	...	...	...	...
Average increase ...	...	349	...	...	503	791	...	
GOALPARA								
Madhusalmuri ...	1,081	...	1,286	...	...	...	...
North Salmara... ...	1,163	...	1,455	...	...	...	...
North Salmara... ...	908	1,284	...	...	...	...	...
Khagrabati ...	1,573	1,806	...	...	...	...	...
Average increase ...	...	275	248	...	...	...	...

6. *Remarks on paddy manurial demonstrations generally.*—These paddy manurial demonstrations have been carried out for the last seven years in the districts of Kamrup and Sibsagar and gradually extended to Nowgong and Goalpara as they were brought under the activities of the department. Their results, so far achieved, clearly show that their use pays handsomely

in the long run. But the cultivator is exceedingly slow to appreciate their value as is evident from the smallness of their demand. The reason is not far to seek. Want of enterprise and lack of capital amongst the cultivators are directly responsible for this indifference. Besides there is no pressure of population to drive them to take to more intensive cultivation. But the present system of growing paddy from year to year without manuring has reduced the outturn on the higher paddy lands in many a tract to such a level that it no longer pays to cultivate them. On such impoverished lands the cultivators often apply what cattle-manure they can save and the artificial manures should be very useful there and appreciated by the cultivators. The attention of the demonstration staff is being directed to try manurial demonstrations in such tracts.

7. Superior Varieties of Rice.—Demonstrations with Indra *sali* of Mr. Hector and, George *sali* of Srijut Narayan Barua, Nakachari, were continued during the year on a larger scale in Kamrup, Sibsagar, Nowgong and extended to Lakhimpur and Goalpara. Both of these varieties gave good results in Kamrup, Sibsagar and Goalpara while only Indra *sali* gave an increased outturn in Nowgong and George *sali* was highly spoken of in Lakhimpur. On the whole both of these are heavier cropping varieties. George *sali* being a coarse rice and Indra *sali* medium, one or the other should suit the requirements of the ordinary cultivator and they are gradually becoming popular.

The improvements due to superior seeds appeals to the cultivator much more easily than anything else as it costs no extra trouble. So there is a vast scope for improved varieties of paddy. But until and unless paddy farms for the selection work are established in the representative paddy tracts in this Valley, this kind of work must be more or less grouping in darkness. It is hoped that the contemplated paddy farm near Jorhat and the proposed appointment of an Economic Botanist, when accomplished, will put this work on the way to rapid progress.

With a view to spread these varieties as widely as possible arrangements have been made to deal out during the coming rains 85 maunds of Indra *sali* and 22 maunds of George *sali* for demonstration and distribution in 5 seer-lots. The distributed seeds will be given as in last year on the understanding that the cultivator will return an equal quantity of seeds in the following year to be distributed amongst their neighbours.

The results of demonstrations with George *sali* and Indra *sali* are given below :—

PADDY VARIETAL DEMONSTRATIONS.

Yield of grain per acre, in pounds.

District.	Local paddy.	Indra-sali.	George sali.	Increase.
1	2	3	4	5
KAMRUP.				
Average of 12 demonstrations	...	2,057	2,135	...
Average of 3 demonstrations	...	1,948	...	2,114
NOWGONG.				
Average of 5 demonstrations	...	2,273	2,610	...
SIBSAGAR.				
Average of 8 demonstrations	...	1,551	1,722	...
Average of 3 demonstrations	...	1,698	...	1,982
GOALPARA.				
Average of 2 demonstrations	...	1,564	1,664	...
One demonstration at Agia	...	2,700	...	2,935
				229

In addition to these demonstrations, Nagra *sali* and Kataktara *aus* from Bengal, "laki" and "sail badal" varieties of shallow water, *aman* growing in 3'-4' of water and "boro" rice were tried in different parts of the valley. "Laki" and "sail badal" gave good results in Sibsagar and Nagra Sali in Kamrup and Goalpara and their trial will be continued in the ensuing season.

8. Sugarcane Variety Demonstration.—The improved varieties, viz.—Striped Mauritius, B 147 and B 376, have everywhere proved superior to local canes and are being highly appreciated by cultivators. Moreover, the rise in the price of "gur" has added an incentive to grow sugarcane. Consequently the increasing demand for the sets of the improved canes grew larger this year, but there were no adequate means to supply them. Even the supply from the Kamrup Farm, which furnished the greater part of sets distributed last year, was cut off and the in-

adequacy of resources was more keenly felt this year. The sets, returned by the cultivators, those grown in demonstration centres, those supplied by the Honorary Correspondent, Srijut Debeswar Gossain, and the produce of the Jorhat Farm—altogether 153,200 in number—were all that were available for distribution and demonstrations in hitherto untouched areas. The sources of supply and number distributed in each locality are noted below:—

Source of supply.		Distribution.	
Jorhat Farm	62,000	Goalpara	... 11,450
Srijut Debeswar Goswami, Honorary Correspondent.	20,000	Khasi and Jaintia Hills	150
Srijut Durgaram Gegai, Lakwa.	47,000	Kamrup	... 4,000
Cane-growing centres in Sibsagar.	16,000	Nowgong	... 26,600
Cane-growing centres in Nowgong.	4,000	Lakhimpur	... 10,900
Cane-growing centres in Kamrup.	3,600	Sibsagar	... 86,000
		Surma Valley	... 12,000
		Chittagong	... 2,000
	158,200		153,200

In distributing these sets arrangements have been made for a return of sets in the next year and creation of cane-growing centres for future supply of sets has been specially aimed at.

Java 33A has this year been given out for the first time from the Jorhat Farm for trial in the cultivator's field. It is a hardy cane of the "khagri" type, but rich in sugar and ratoons well. A few thousand sets of yellow Tava, a robust cane with hard rind and a heavy yielding capacity, though poor in juice, have also been distributed for trial in localities where jackals are very troublesome to the striped Mauritius and Barbadoes canes.

The improved varieties—striped Mauritius, B 147 and B 374 have thoroughly established their reputation and demonstrations except in remote places are no longer necessary. However a few were carried out in Kamrup, Nowgong and Goalpara. The figures of Goalpara demonstrations are not worth mentioning and

the following gives the average results of those of Kamrup and Nowgong :—

District.	Improved canes.	Local canes.	Increase.
1	2	3.	4
KAMRUP.			
Average of 4 demonstrations	...	3,414	2,377 1,037 lbs. per acre.
NOWGONG.			
Average of 6 demonstrations	...	3,496	2,360 1,130 lbs. per acre.

9. *Sugarcane—Green manuring.*—As has been demonstrated from time to time green-manuring with *dhainch* or cowpea for sugarcane is exceedingly profitable. But the cultivator is not willing to look one year ahead and take the trouble of growing a green-manuring crop and turn it in. Besides, the green-manuring crop requires to be *hoed* in at a time when he can ill-afford to spare the labour for it and there is the additional expenditure and trouble in fencing the green-manure crop. Consequently green-manuring has not become popular with the cultivators and it will take time to make them appreciate it. But owing to recent rise in the price of *gur*, sugarcane is increasingly engaging the attention of the cultivator and attempt at improved methods of cultivation and manuring should bear fruits.

10. *Sugarcane Mills.*—The three roller iron sugarcane crushing mill has become popular almost everywhere and is displacing the wooden mills. Yet one would find the wooden mill even in places close to a town like Jorhat. As the cane cultivation of an individual rayat is very small he is not ordinarily ready to purchase a costly iron mill and the spirit of co-operation for combining several of them is wanting. So, the process of eliminating the wooden mill will take a pretty long time. But there was a recent stride made during the year under report. In spite of the increased cost of the mill—Rs. 80 in the early part of the season and Rs. 86 in the latter as compared with Rs. 65 the pre-war price—111 mills were actually sold during the current year against 38 in the previous year. Of these 56 were sold in

Kamrup, 52 in Nowgong, 19 in Goalpara and 14 in Sibsagar. The use of the shallow *gur* boiling pan also is increasing 33 of these pans being sold during the year under report. Many more mills could have been disposed of but such a rise in the demand was not anticipated and there was great difficulty in procuring them from Calcutta. In the ensuing season the demand may increase still more—much to embarrassment of the Seed Depôt with the limited means at its disposal. As to keeping the mills in repair, spare parts are stocked in the Seed Depôt, Gauhati, and arrangements are being made to have the necessary reparation executed at the Jorhat Railway workshop.

11. Potatoes—Demonstration with superior varieties from Shillong.—These demonstrations have been continued in Kamrup and Sibsagar for the last six or seven years and have thoroughly established the superiority of the Shillong seed over the "deshi" varieties, or the locally preserved and Bazar seed. As their result, the demand for the Shillong seed is rapidly increasing, and over 1,200 mds. were sold through the Seed Depôt, Gauhati, in 1919 against 600 mds. in 1918 and about 200 mds. in 1917. However to push on their introduction in new localities a number of demonstrations were carried out in Lakhimpur, Sibsagar, Nowgong, Kamrup and Goalpara. The figures of Goalpara and Lakhimpur demonstrations are not worth mentioning and those of Sibsagar were damaged by the potato blight. The average outturn of those in Nowgong and Kamrup are given below:—

DEMONSTRATION WITH SUPERIOR VARIETIES OF POTATOES.

Yield per acre in pounds.

District.	Shillong varieties.	"Deshi" varieties or Bazar seed.	Remarks.
1	2	3	4
	Lbs.	Lbs.	
KAMRUP.			
Average of 18 demonstrations	...	6,100	4,631 Increase 1,469 lbs.
NOWGONG.			
Average of 9 demonstrations	...	6,208	4,761 Increase 1,444 lbs.

In one centre—Kathkotia near Golaghat, in the Sibsagar district where the crop escaped the blight, the Shillong potatoes gave an outturn of 13,477 pounds against 4,317 pounds of the "ceshi" variety. The soil being exceptionally rich and cultivation carefully done this demonstration clearly signifies that the more intensive is the cultivation the better the chance for the Shillong potato.

With a view to see how it fares in Assam, Darjeeling potato was tried in four centres in Kamrup and gave an average increase of over 4,000 pounds per acre over the Shillong potato. Though not necessarily conclusive the results are striking and interesting and the Darjeeling potato took about a month longer to mature.

12. Jute—"Kakya Bombai" of Mr. Finlay's Selection.—A number of demonstrations with this improved variety of jute were carried out in Kamrup, Nowgong and Gualpara where jute is largely cultivated. The results, given below, are quite satisfactory. The variety is increasing in popularity as well as in demand. In Sibsagar jute is not an important crop and the cultivators with whom the demonstrations were arranged for did not take much interest in them; consequently they proved useless. Only in the Mazuli the cultivation was properly cared for and its owner got 2,896 lbs. of fibre per acre by growing the "Kakya Bombai".

To meet the increasing demand for its seeds five acres had last year been put under "Kakya Bombai" in the Kamrup Farm which produced 45 maunds of seed. This supply together with 8 maunds purchased from Tayab Ali was enough to meet the requirements of the Valley. About 30 maunds of this seed have this year been used for demonstration and distribution in $\frac{1}{2}$ pound packets. Besides, the seeds returned by the cultivators, who took "Kakya Bombai" seeds last year, have also been distributed in their localities.

Outturn of fibre per acre in pounds.

District and centre.	"Kakya Bombai" jute.	Local jute.	Remarks.
1	2	3	4
NOWGONG.			
Rupohi	...	1,921	1,754
Naramuri	...	1,996	1,815
Siamuri	...	1,936	1,149
			Average increase 378 pounds per acre.

District and centre.	"Kakya Bombai" jute.	Local jute.	Remarks.
1	2	3	4
KAMRUP.			
Khanamukh ...	2,162	2,011	
Majerigaon ...	1,057	600	
Dharanitul ...	1,516	995	Average increase 378 pounds per acre.
GOALPARA.			
Gauripur ...	1,575	1,000	
Jbagrapara ...	1,286	817	
Khagrachari ...	842	628	
Shabeganj ...	1,613	1,279	Average increase 405 pounds per acre.

13. *Fodder*.—Attempts have from time to time been made to popularise *jowar* and cowpea for fodder, but the cultivator has not taken it kindly. The reason is not far to seek. Plenty of grazing lands in most places and the practice of communal grazing have taught the indigenous cultivator to keep his cattle on what they can pick for themselves and artificial feeding is unknown to him. He would even sell off or burn his own paddy straw, which, if carefully saved, could go a great way to meet his fodder requirements. But the time is now fast changing and the Assamese cultivator too. In the western extremity in Goalpara people are taking to growing fodder. Guinea grass has been grown successfully in the Jorhat Farm and at Barpathar Farm of Srijut Debswar Gosain Honorary Correspondent, and it is proposed to distribute some of its stock in Goalpara, Kamrup and Sibsagar.

14. *Miscellaneous Crops*.—A few maunds of Patnai *kheeri*, and *masuri* were distributed in various centres in Kamrup, Goalpara, Nowgong and Sibsagar. Wheat—Pusa Nos. 4, 6 and 12; *sonamug*, linseed, groundnut, cowpea, etc., were also tried at various places. But owing greatly to the indifference of the cultivator and partly to climatic conditions as well as want of acclimatised seeds these demonstrations were not a success.

15. *The Meston plough*.—As in previous years demonstrations with this plough were continued in various places. Its work is appreciated but the plough is rather heavy for ordinary

country bullocks and its cost has increased, besides, there is no use for it in paddy cultivation; consequently there has been little progress in its popularity except to a small extent in Kamrup.

16. *Conservation of cattle manure*—Conservation of cattle manure in covered sheds and pits has continuously been demonstrated, but the cultivator is slow to take it up in practice. During the year under report 104 new sheds were erected in Sibsagar and 5 in Kamrup. It is already popular in the sugar-cane tracts in the district of Sibsagar.

17. *Agricultural work in the Sadiya Frontier Tract*.—Mr. M. Smith continued in the post of Agricultural Instructor throughout the year. He was mostly occupied in the management and supervision of the small Experimental Stations at Sadiya, Pashighat and Rotung. The district work consisted of free distribution of Garo cotton seed, fruit plants and vegetable seedlings, demonstrations in wet paddy cultivation and castration of weedy bulls.

At the Sadiya Experimental Station an area of about 9 acres is under cultivation and the following crops were grown there during the year :—

Sugarcane.—There was about $\frac{3}{4}$ acre of the Ratoon cane which yielded about 54 maunds of *gur* and fetched Rs 282.8. The same area had yielded last year from its plant canes about 28 maunds of *gur* sold for Rs. 111. Last year about 800 setts were distributed free. There was an extension in the cane area, an acre being put under the improved varieties of S. M., B 147 and B 376 during last season. The crop made excellent growth. Crushing and *gur* boiling was in progress at the end of the year and a large number of setts were expected to be available for free distribution.

Groundnuts.—In old nursery garden there was an yield of only 9 maunds per acre and at another place 15 maunds per acre while the crop of the Experimental Station gave, though there was a luxuriant growth of plants, only a miserable outturn in nuts.

Abor maize tried for the first time on $1\frac{1}{2}$ acre yielded at the rate of 1½ maunds per acre.

Aus paddy was sown on about $1\frac{1}{2}$ acre and yielded only 36 maunds.

Potatoes.—Superior varieties from Shillong were tried side by side with locally preserved seeds from last year. But a serious attack of the potato blight damaged the crops.

Pusa Wheats—Nos 4, 6 and 12 were tried and found promising but the unusually early rains lodged and damaged the crop very much.

Oats grown on an area of $\frac{1}{3}$ acre gave quite good results with an outturn of $18\frac{1}{4}$ maunds per acre.

The coffee plants as well as the fruit trees, namely, guava, peach, orange, lime, pomelo, lichee, papaya, etc., are progressing well and some of them have begun to fruit. The papayas covered an area of $\frac{1}{3}$ acre and yielded good sized and sweet fruits.

Cold weather vegetables covering an area of 2 acres yielded very good results and fetched Rs. 631-8-9.

The garden at Pashighat had one acre under cold weather vegetables and another acre under groundnuts. There were also 4 acres of terraced rice. The groundnuts yielded about $1\frac{1}{2}$ maunds and terraced paddy about $27\frac{1}{2}$ maunds per acre.

During the year under report terracing was commenced at Ramindambong where $\frac{1}{2}$ acre was put under wet rice which yield a crop of $2\frac{1}{2}$ maunds per acre.

At Rotung there was wet rice on $12\frac{1}{2}$ acres of terraces. The outturn of paddy from this area was about 460 maunds or at the rate of over 36 maunds per acre.

The improvement of cattle continued to receive a good deal of attention. A large number of weedy bulls, 201 in Sadiya, 24 at Pashighat, were castrated during the last cold weather. There were also 2 breeding bulls at Pasighat and 2 at Sadiya.

18 Agricultural work in the Garo Hills. - H. Momin, a Garo Demonstrator, is in charge of demonstrations in this district. He was on tour for 299 days during the year under report and worked under the supervision of the Agricultural Inspector, Goalpara.

The hilly nature of the district and want of facilities in communication stand in the way of proper supervision and expansion of agricultural work there. Besides its people are backward and superstitious. The principal crops are paddy and cotton grown on the *jhum* system of mixed cropping. Demonstrations in terracing for wet paddy cultivation had been carried out with some amount of success, but owing to depredation of wild animals on the terraced areas, the system has not become popular with the cultivators. Yellow cotton was tried but the people looked upon it as inauspicious. Consequently potato was the main item of demonstration.

Shillong potato (*Magnum Bonum*) was demonstrated at 13 centres. The area of the plots in five places was $\frac{1}{2}$ acre and in

the rest $\frac{1}{10}$ acre. The seed rate was 10 maunds of tubers per acre. The highest yield was $96\frac{1}{2}$ maunds and the average about $43\frac{1}{2}$ maunds per acre.

19. *The work of the Seed Depôt, Gauhati.*—With the exception of the distribution of sugarcane setts, which is managed by the demonstration staff, the supply of seeds, manures, implements, etc., both for demonstration and sale to the public, is undertaken by the Seed Depôt, Gauhati. The year under report saw a great expansion in the activities of the Seed Depôt.

The total quantity of seeds and manures issued during the year was about 71 tons, value Rs. 12,642-5-10 and the number of implements, etc., 281, value Rs. 12,937-13-0. Of these 56½ tons of seeds, value Rs. 9,758-6-7 and 207 implements, value Rs. 12,393-13-0 were sold. The remainder were supplied free for demonstration purposes and to Government farms.

Amongst seeds the chief item was the Shillong seed potatoes. There were 1,403 maunds of them, value Rs. 7,578 (as against 529 maunds, value Rs. 3,867 of last year), of which 1,22½ maunds, value Rs. 6,485 were actually sold. Of implements, the main issues were iron sugarcane mills, of which 141, value Rs. 11,310 (as against 38 of last year) were sold and 5, value Rs. 402, handed over for use in demonstration. The following were other items of importance :—

Name.	Quantity sold.	Quantity supplied free for demonstration.	Total quantity.
1	2	3	4
	Mds.	Mds.	Mds.
Dhaincha seed	87	21	108
Jute seed	2½	28½	31
Seed Oat	66½	8½	75
Wheat Oat	69	12	81
Masur	4	8	12
Khetari	12	7	19
Indra Salt	5	45	50
George "	5	5½	10½
Gur boiling iron pan	Nos. 38	Nos. 2	Nos. 35

The small seed packets of cold weather vegetables grew in popularity as well as in the bulk of their sale. During the year under report their sale-proceeds amounted to over Rs. 530.

The following statement shows the working of the Seed Depôt for the year under report. Allowing depreciation and cost of the establishment and house-rent, etc., there was a net profit of Rs. 358-4-6.

A Statement showing the working of the Gauhati Seed Depôt for the year ending the 31st March 1920.

Assets or receipts.		Liabilities or Charges.	
1	2	1	2
	Rs. a. p.		Rs. a. p.
Total amount realised from sale during the year	22,587 2 7	Rent and taxes	... ... 484 0 0
Deduct—	Rs. a. p.	Establishment	... ... 400 8 0
Outstanding of last 508 13 0 year realised during the year.		Contingencies—	
Outstanding pre- 20 15 0 vious to last year realised during the year.		Postage, etc.	... 175 0 0
Amount realised by 387 11 0 sale of demonstra- tion implements supplied in previous years	917 7 0	Hot and cold weather charges.	20 0 0
Receipts of current year	21,419 11 7	Other charges	... 534 10 3 739 10 3
Add—		Cost of purchasing stores	... 24,483 0 4
Bills outstanding...	732 8 0	Depreciation on value of stock in hand for storing at 10 per cent. of cost price.	295 0 0
Value of stores supplied free for demonstrations.	3,347 9 9	Freight on stores not adjusted during the year (credit notes).	605 4 6
Value of concession for seeds supplied to the Honorary Correspondents at reduced rates.	80 5 6	Cost of bills outstanding on account of stores purchased.	18 1 3
		Value of seeds supplied free from Farms.	915 6 0
		Deduct cost of bills for stores purchased last year.	27,875 14 4
			153 1 9
			27,841 11 1
		Cost price of stock in hand on 1st April 1919.	332 3 1
		Cost price of stock in hand on 31st March 1920.	2,834 1 0
Profit	358 4 6	Increase in stock	... ... 2,619 13 3
Total	25,221 14 4	Total	... 25,221 14 4

20. *Work of the Honorary Correspondents.*—There were in the beginning of the year 15 Honorary Correspondents in the Assam Valley and one in the Garo Hills. Maulvi Tayab Ali of Sonapur and Bishnu Charan Dutt of Tura are since dead. In the Maulvi the Department lost an enthusiastic and useful Honorary Correspondent.

Srijut Pithubar Saikia of Khowang had been trying George *sali* of Narayan Borua and Indra *sali* for the last three years and found George *sali* distinctly superior to local paddies while Indra *sali* gave indifferent results in his locality.

Srijut Deveswar Goswami of Badlipar (Golaghat) has been continuing his experiments with canes—striped Mauritius giving all round good results and B 147 showing signs of deterioration in its ratooning quality. He is also growing turmeric and arrowroot with commercial views. He also rendered much assistance to the Department by supplying 20,000 setts of the improved canes for distribution.

Srijut Narayan Baruah is reported to have distributed Garo cotton seeds and his George *sali* in his neighbourhood.

Babu Jnan Chandra Ray reported that he had been pushing on the cultivation and distribution of the improved canes and George *sali*.

Srijut Bhogadatta Hazarika of Dharan tul, Nowgong, carried on experiments with the Shillong potatoes, Kakya Bombai jute, improved canes and Indra *sali* with satisfactory results.

The late Maulvi Taiyab Ali of Sonapur rendered some assistance by growing Kakya Bombai jute for seed of which 8 maunds was supplied to the Gauhati Seed Depot.

L. BARTHAKUR,

JORHAT, }
The 15th May 1920. }
Offg. Deputy Director of Agriculture,
Assam Valley.

REPORT OF AGRICULTURAL DEMONSTRATION IN
THE SURMA VALLEY CIRCLE FOR THE YEAR
ENDING THE 31st MARCH 1920.

Staff.—Maulvi Fazlul Haque Ahmed was in charge of agricultural demonstrations in the Surma Valley throughout the year. On the death of L. Harry Singh, the Fruit Inspector, the Agricultural Inspector of Cachar was put in charge of the work in North Cachar Hills, in addition to his own duties, under the supervision of the Superintendent of Agriculture. The Superintendent was also in charge of the Water Hyacinth operations which were conducted on a larger scale than in previous years. A temporary Overseer was entertained for this work for seven months. The demonstration staff was strengthened by the addition of one Agricultural Inspector and two demonstrators towards the end of the year under report. It is intended to have two more Inspectors in the present year. The staff of demonstrators is still very inadequate, but its increase depends on the rate at which the men can be trained,—which will necessarily take some time. It is worse than useless to take untrained or insufficiently trained men. Maulvi Mohsin Ali, a graduate of Sabour, completed his training in December and was placed in charge of Cachar in January. Babu Kamini Kumar De was transferred to Habiganj. Prafulla Babu—who was in charge of both the Habiganj and South Sylhet subdivisions—remaining in charge of the latter subdivision only. Babu Binode Behari Das continued in charge of North Sylhet and Karimganj subdivisions. He is expected to be relieved of the Karimganj and Sunimganj subdivisions during the coming year. The Inspectors were assisted by nine demonstrators posted as follows:—

Sylhet, Barlekha, Karimganj, Kulaura, Maulvi Bazar, Shastiganj, Chhatiain, Silchar and Hajlakandi. The services of the demonstrator of Silchar had to be dispensed with for unsatisfactory work and he was replaced by Abdul Mannan, a trained apprentice from the Karimganj Farm. The post of a new demonstrator for Chhatiain was sanctioned during the year to which Saresh Chandra Kar, a trained apprentice, was appointed. Girindra Kumar De, on being relieved from the Karimganj Farm reverted as Agricultural demonstrator and was posted to Karimganj.

The Superintendent of Agriculture was on tour for 23^½ days during which he travelled 1,660 miles by road and 1,500 miles by boat. He frequently visited all the centres of demonstrations

in the course of his tour. The number of days spent on tour by the Agricultural Inspectors were as follows :—

	Number of days on tour.	Number of miles travelled by road.	Number of miles travelled by boat.
1	2	3	4
Babu Binode Behari Das ...	230	1881	948
Babu Prafulla Chandra Datta ...	327	2256	350
Babu Kamini Kumar De ...	250	...	...
Maulvi Mohibin Ali ... (9th December to 31st March).	73	993	15

These do not include the number of days spent in supervising demonstrations within 5 miles of headquarters.

The work of demonstrations on a systematic line may be said to have been taken up in this Valley since 1917. Very little could be done before this for want of a suitable staff : it was only during the last year that the Director could, for the first time, make time to visit any demonstration. His visit was a great incentive to the whole staff and gave an impetus to the agricultural activities in this Valley. With better arrangements for supervision, considerable improvements are now noticeable in the whole staff who are throwing themselves in their work with zeal. Results of last year's demonstrations indicate the increasing care which the Inspectors and demonstrators are now bestowing on their work.

2. *Summary of work done.*—The result of the spade work of the previous years is now beginning to be felt in the increased interest which is being taken by cultivators in our seeds and manures. During the year under report $37\frac{1}{2}$ maunds of bone-meal, 1 maund and 31 seers of *dhainch* were sold for the first time in this Valley. A much larger quantity of bone-meal would be sold if it could be procured at the old rate, but the present price is prohibitive. Eleven sugarcane mills and 6 pans were sold, compared to 6 and nil respectively during the previous year. The demand for sugarcane cuttings of improved varieties was very heavy, particularly in Cachar. The indent exceeded 1,00,000, of which only 30,000 cuttings could be supplied. The most gratifying feature of the year's work was perhaps the sale of over 80 maunds of Kaka Bombai jute seed, mainly in the Habiganj subdivision. As the result of previous demonstrations

the cultivators have become thoroughly convinced of the superiority of the seeds. It is known that many cultivators saved the Kakyā Bombai seed for their own requirements from their own crops and the total quantity of the Kakyā Bonbai jute seed sown this year may be safely put down at 100 maunds. As this will sow about 800 acres and as an increase of 5 maunds per acre has been usually obtained during the last three years from the Kakyā Bombai seed, the value of the increased output may be estimated at Rs. : 2,000 valuing jute at Rs. 8 per maund. The cultivators purchased our seed in preference to local seed although the latter sold at annas 4 to annas 5 per seer, whereas our seed cost annas 9 per seer.

As the demonstrations are extending to new areas, a much larger quantity of seed will be required next year. Arrangements for an adequate supply of seed for next year are being made. With a view to encourage the cultivators to grow their own seeds the following scheme is being tried during the year in a few localities in the Habiganj subdivision.

Local cultivators are being supplied with small quantities of seed for growing solely for seed in a small plot near their home-stead. Twenty maunds is being distributed during the year in accordance with this scheme. The produce of this, if the whole area is actually reserved for seed, may be expected to sow 5,000 acres next year.

Indra *sail* and George *sail* paddies have definitely proved their superiority over the local varieties in most of the places where they were tried. It is known that most of the people originally supplied with pure seed have preserved the whole of their crop for seed and distributed this among their neighbours. With a view to their larger distribution, 40 maunds of Indra *sail* and 20 maunds of George *sail* are being distributed in 5-seer packets. The increased output of the produce may, on a conservative basis, be valued at Rs. 9,000. It will be seen that the value of the increased output due to the use of improved jute and paddy seeds alone may be estimated to exceed Rs. 40,000 and this will be obtained at very little extra cost to the cultivators.

During the year under report, the items of demonstrations were very much the same as in previous years and consisted of the following :—

- (1) Manurial tests on paddy.
- (2) Trial of superior varieties of paddy.
- (3) Jute demonstrations.

- (4) Introduction of superior varieties of sugarcane, iron mills and shallow pans.
- (5) Introduction of Shillong potatoés.
- (6) Introduction of pulses and oil-seeds.
- (7) Trial of new crops.
- (8) Miscellaneous.

The manurial demonstrations on paddy consisted of the following :—

- (a) Bone-meal.
- (b) Bone-meal and *dhainchha*.
- (c) Lime-stone and *dhainchha*.
- (d) Bone-meal and oil-cake.

Bone-meal was applied at the rate of 247 pounds (3 maunds), ground lime-stone 823 pounds (10 maunds), oil-cake at 494 pounds (6 maunds) per acre. *Dhainchha* was sown at the rate of 30 pounds per acre and ploughed in about 3 weeks before transplanting.

The yields from the various manures in the different localities are shown in the following table :—

Kind of treatment,	Number of demonstra- tions.	Increase per acre, in pounds.			Profit or loss.	Remarks.
		Average increase in out- turn.	Value of increased crop at Rs. 3 per maund.	Cost of manuring.		
1	2	3	4	5	6	7
			Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bone-meal	1	—720	... 0 0 0	9 0 0	—35 5 0	Decrease.
Bone-meal and <i>dhainchha</i>	1	162	6 3 0	10 12 0	—4 9 0	North Sylhet.
Limestone and <i>dhainchha</i>	1	10	0 6 0	11 12 0	—11 8 0	
Bone-meal	1	—251	... 0 0 0	9 0 0	—18 3 0	
Bone-meal and <i>dhainchha</i>	1	1,154	42 4 0	10 12 0	31 6 0	South Sylhet.
Bone-meal and oil-cake	1	390	14 5 0	21 0 0	6 11 0	
Bone-meal	1	402	14 11 0	9 0 0	5 11 0	
Bone-meal and <i>dhainchha</i>	1	483	15 14 0	10 12 0	5 2 0	Karimganj.
Limestone and <i>dhainchha</i>	1	66	3 7 0	11 12 0	—9 5 0	
Bone-meal	1	351	12 14 0	9 0 0	3 14 0	
Bone-meal and <i>dhainchha</i>	1	214	7 14 0	10 12 0	—3 14 0	Hailiganj.
Bone-meal and oil-cake ...	1	184	6 12 0	21 0 0	—14 4 0	

Cachar.

Treatment.	Average increase in out-turn.	Value of increased crop at Rs. 3 per maund.	Cost of manuring.	Profit or loss.	Remarks.
1	2	3	4	5	6
	Lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bone-meal	... ...	382	13 15 0	9 0 0	4 15 0
Bone-meal and <i>dhaincha</i>	...	359	14 4 0	10 12 0	3 8 0
Limestone and <i>dhaincha</i>	...	60	2 3 0	11 12 0	-9 9 0

In North Sylhet and South Sylhet, bone-meal alone produced no effect, whereas in Habiganj, Karimganj and Silchar, the cost of the manure was recovered even in the first year. As noted by the Director in his last annual report, bone-meal only paid when applied on comparatively poor soil. Greater care was exercised in the selection of the bone-meal plots to which is largely due the comparatively satisfactory results, as will appear from the above figures. Combined with *dhaincha*, bone-meal has proved satisfactory in almost every case. Although the full price of the bone-meal has not been recovered from the profits of the first year in every case the deficit is so small that there is no doubt that it will be more than recouped during the next year as the effect of bone-meal continues for three years. All the bone-meal plots will be kept under observation during the next two years.

Results of Bone-meal applied in 1918 and 1917.—It was found that some of the plots in which bone-meal was applied in 1917 and 1918 were not really suitable for demonstrations, as the conditions in the check plots and the demonstration plots were not similar and there were other factors vitiating the results. The

results of the plots which were considered suitable were recorded and are shown below :—

Applied in 1918.

Kind of treatment.	Number of demonstrations.	Average in pounds per acre.			Value of increased crop at Rs. 3 per maund.	Cost of manuring.	Profit or loss.	Remarks.
		1918.	1919.	Total increase.				
1	2	3	4	5	6	7	8	9
Bone-meal ...	2	91	216	207	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bone-meal and Oil-cake,	1	984	384	1,348	50 11 0	16 8 0	34 3 0	North Sylhet.
Bone-meal ...	3	80	1,071	1,111	40 11 0	9 0 0	31 11 0	
Oil-cake ...	1	123	185	308	19 0 0	9 0 0	1 9 0	South Sylhet.
Limestone and ash mixed,	1	197	118	315	11 8 0	13 12 0	-0 3 0	
Bone-meal ...	2	300	162	862	20 5 0	9 0 0	11 5 0	
Oil-cake ...	1	-58	355	298	10 4 0	9 0 0	1 4 0	Karimganj.
Dhainga green manuring,	1	684	222	806	29 8 0	1 12 0	27 12 0	Habiganj.

Applied in 1917.

Kind of treatment.	Number of demonstrations.	Average increase in pounds per acre.			Total increase.	Value of increased crop.	Cost of manuring.	Profit or loss.	Remarks.
		1919.	1918.	1917.					
1	2	3	4	5	6	7	8	9	10
Bone-meal ...	1	568	890		1,213	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bone-meal ...	1	117	336		453	15 18 0	9 0 0	6 15 0	South Sylhet.
Bone-meal ...	...	214	434	594	1,242	37 14 0	9 0 0	28 14 0	
Dhainga ...	...	311	611	531	1,853	41 4 8	1 12 0	39 8 6	Silchar.
Bone-meal and ash mixed,	...	606	453	368	1,630	49 19 0	10 12 0	39 0 0	

It will be noticed from the results given above, that coupled with an organic manure, bone-meal has usually given very good results. The effect of *dhainchā* by itself as well as in combination with bone-meal has been found highly profitable and is being tested on a larger scale during the coming season.

Limestone does not appear to have produced much effect.

Introduction of superior varieties of paddy.—With a view to introduce superior varieties of paddy, *Indra-sail* and *George-sail* were tested against the local varieties in all the demonstration centres in Sylhet and in Cachar. The results are noted below :—

Superior varieties.	Number of demon- strations.	Average outturn per acre.	Average outturn of local paddy per acre.	Average increase per acre.	Profit.	Remarks.
1	2	3	4	5	6	7
<i>Indra-sail</i>	15	2,210	1,960	250	10 0 0	
<i>George-sail</i>	11	2,280	1,970	310	12 12 0	Sylhet
<i>Indra-sail</i> ... ..	..	1,127	1,127	nil	nil.	
<i>George-sail</i> ... ..	..	1,709	1,127	581	21 4 0	Cachar.

In Cachar, although on the average, *Indra-sail* gave the same outturn as local varieties, it beat the local varieties in many individual cases. It will again be carefully tested during the coming season.

The results indicate that although both *Indra-sail* and *George-sail* are superior to local varieties, in certain localities *Indra-sail* may prove more suitable than *George-sail*, whereas opposite may be the case in altered conditions. Demonstrations are being arranged during the coming year, to test which is the more suitable variety for each locality.

With a view to testing these two varieties widely and to popularise them, a few 5 seers seed packets of both of these varieties were distributed last year to selected cultivators in each centre. The results were very encouraging. Forty maunds of *Indra-sail* and 20 maunds of *George-sail* will be distributed in accordance with the above scheme during the coming season. The seeds will be recovered and redistributed during the next year.

Jute Demonstrations.—These consisted of :—

(a) Introduction of superior varieties, e.g., Kakya Bom-bai.

(b) Manurial demonstrations.

(c) Introduction of jute cultivation in new localities.

The results are summarised below :—

Kind of demonstration.	Number of demonstra-tion plots.	Average increase in pounds per acre.		Remarks.
		Over the country variety.	Over the una- nured plot.	
1	2	3	4	5
Variety	...	3	495	...
Bone-meal	...	1	...	44
Water Hyacinth ash	...	1	...	355
Variety	...	2	300	...
Bone-meal	...	2	...	263
Water Hyacinth ash	...	1	...	112
Variety	...	3	364	...
Bone-meal	...	1	...	658
Water Hyacinth ash	...	1	...	369
Silt manure	...	1	...	925
Variety	...	2	121	...
				Karimganj.

It will be seen that the Kakya Bombai jute seed has proved its superiority in every case. As a result of these demonstrations, over 80 maunds of Kakya Bombai jute seed have been sold during this year as against 13½ maunds last year. The response of jute to manurial treatments especially to Water Hyacinth ash is also very encouraging. Bone-meal was used at the rate of 3 maunds per acre and at Habiganj it gave a profit of Rs. 55 per acre, valuing the jute at Rs. 8 per maund. Water Hyacinth ash was applied at the rate of 6 maunds per acre and gave a profit of Rs. 24 per acre, valuing the ash at Rs. 2 per maund. When made by the cultivator himself, Water Hyacinth ash can be prepared at half this cost.

Sugarcane.—In previous years difficulty was experienced in recording the actual outturns of the improved varieties, as only a small number of setts could be obtained from the Assam Valley. The plots were small and usually patchy due to defective germination, on account of the damage sustained by the setts during transit. About 30,000 cuttings of B147, B376 and Striped Mauritius were obtained from Assam Valley during the last season and planted in Sylhet and Cachar. They were planted in about 40 plots, but about 50 per cent. of the setts failed to germinate. The canes which grew did very well, particularly in Silchar and South Sylhet, but the record of outturns were valueless for purposes of comparison. It was decided to reserve the whole of the crop for cuttings, so that during the present year they might be planted under the same conditions as the local varieties on fairly large plots and reliable comparative figures recorded. There is no doubt that the improved varieties are gaining in popularity among the ryots. It was only possible to purchase 2,000 cuttings in excess of the quantity originally supplied as the cultivators refused to sell their surplus cuttings, but kept them for their own use.

The 30,000 cuttings originally supplied have, however, been recovered and supplied to neighbouring cultivators, on condition that they will return a similar number of cuttings next year. By extending this system the question of the supply of cuttings will be solved automatically. The improved varieties, however, are as much in favour with jackals and other wild animals as with men and must be protected by strong fencing. The cultivators are beginning to realise that it will pay to incur the extra expenditure. It is also necessary to earth them carefully as otherwise on account of their length and thickness they are liable to be blown down by strong winds.

The use of three-roller iron-mill and shallow pan are being demonstrated and are steadily gaining in favour. Eleven mills & pans were sold through the Seed Depôt as against 6 mills during the last year. Many people also hired the mills from the agencies of Kenwick & Co. If the sugarcane growers would join in co-operative credit societies and purchase a mill and a pan for each society, their use might spread very rapidly. It is rather difficult for an individual cultivator to purchase these mills as the price of a single mill has gone up to Rs. 100. There is no doubt of their superiority and the output of *gur* could be appreciably increased by their use.

Potatoes—With a view to introduce the superior varieties of the seed of Shillong, a number of demonstrations were laid down in all the centres. The results are tabulated below :—

Place.	Number of demon- strations.	Tests : yield per acre in pounds.		Size tests of Shillong variety in pounds per acre.		Average increase per acre.	Remarks.
		Shillong	Country	Big sized seeds.	Small sized seeds.		
1	2	3	4	5	6	7	8
orth Sylhet	...	5	9,075	6,357	...	...	2,718
outh Sylhet	...	4	7,068	4,782	...	...	2,236
Karimganj	...	5	5,692	spoilt	...	...	By rain at harvest time.
Silchar	4,914	3,113	...	...	1,801
		4,800	2,956	1,844

The superiority of the Shillong potatoes is very evident. The trouble with all hill potatoes when brought down to the plains, however, is that they rot very rapidly, before planting, as well as after the crop is harvested. Considerable difficulty is therefore experienced in supplying the seed as they cannot be stored for any length of time. For the same reason the crop sells at a lower rate than the country potatoes as they do not last long. During the year under report, the season for potatoes and for all cold-weather crops was very unfavourable as there were heavy showers both during the planting and harvesting seasons. In spite of all these difficulties, the following quantities were sold :—

					Mds. mra.
Habiganj	...	...	...	...	166 0
South Sylhet	...	...	...	...	18 0
North Sylhet	...	...	...	...	69 20
Karimganj	...	...	...	...	1 0
Silchar	...	...	...	...	5 20

At Habiganj particularly, the Shillong potatoes are very popular and the difficulty is to arrange for an adequate supply.

Introduction of pulses and oil-seeds.—A determined and organised effort was made during the year for the extension of the area under pulses and oil-seeds. A leaflet was printed in Bengali and distributed broad-cast, setting out the advantages of growing pulse crops and giving detailed cultural directions. The Agricultural Inspectors and the Agricultural demonstrators spoke to as many people as possible in the course of their tours.

Seeds of all pulses were stocked at the Sylhet Seed Depot and sold to cultivators at cost price, and in some cases, even at reduced prices. The efforts met with considerable success and 75 maunds of pulses and 9 maunds of oil-seeds were sold from the Sylhet Seed Depot alone. Many people, particularly in Habiganj, purchased seeds also from local dealers and a larger area was sown with pulses than in previous years.

Unfortunately on account of the rains in November, and particularly in February and March during the ripening season, the crops were very poor and in some areas they could not be harvested at all.

A number of demonstration plots were laid down, about 50 per cent. of which only could be harvested, the results of which are tabulated below :—

Pulse.	Outturn in pounds per acre,		
	Sylhet.	Cachar.	
1	2	3	
<i>Khesari</i> 634	78
Peas	1,167	...
<i>Musuri</i>	111
Peas	220

Oil seeds.— Increase of outturn in pounds per acre.

	Sylhet.	Cachar.
Linseed (Calcutta versus Local)	— 39	117
Mustard (Assam versus Local)	... 37	334

In Sylhet the imported oil-seeds do not appear to be markedly superior to the local varieties.

Introduction of new crops.—Cowpea and *Jowar* were tried for fodder in many places but did not meet with much success mainly because they were rain-weather crops and there was usually plenty of natural fodder in the rains.

Groundnut was tried at 15 centres in Sylhet and at 12 centres in Cachar and gave an average outturn of 1,260 pounds and 1,720 pounds, respectively, in the two districts. As groundnut grows without much trouble in comparatively poor soil, the demonstrations will be continued.

Wheat was grown in a few places with satisfactory results. Arrangements for regular demonstrations will be made during the next season.

Miscellaneous.—The use of the Meston plough was demonstrated in various places but did not produce much impression. It is mainly a plough for high-land cultivation in loamy soils the area of which in this valley is strictly limited. The present high price is another disadvantage.

In Sylhet, Water Hyacinth ash was tried as a manure with the *kachu* (*Colocasia antiquorum*) at a few centres. This is by far the most important of the garden crops grown in this district and can be almost regarded as a field crop. The ash was applied at the rate of 6 maunds per acre and an average increase of 360 pounds per acre was obtained. This was very satisfactory and the demonstrations are being extended during the present season.

The Agricultural demonstrators continue their effort to induce the people to preserve their cowdung in covered sheds. The number of such sheds is increasing.

As a result of the work done during the last few years, it may be now said that the most fruitful lines of demonstration lie along the distribution of improved seeds (mainly paddy, jute and sugarcane), green-manuring paddy lands with *dhaiicha*, and the introduction of the pulse crops. In future the energies of the demonstration staff will be concentrated mainly on these, demonstrations of special items being conducted through selected persons.

Combating the Water Hyacinth pest will also form an important part of the Department's programme.

In addition to the demonstration plots a new agency for popularising the work of the department was tried during the year and met with considerable success. It is impossible to reach any considerable proportion of the masses with the limited staff at our disposal. It was felt that advantage might be taken of

the fairs (which are held in large numbers in this valley in the cold weather) to popularise the work of the Department among the masses. Two fairs were accordingly selected, Dhakadakshin in Sylhet and Katigarah in Silchar. A collection of the improved seeds, manures, and implements was exhibited and the fairs were attended by the Inspectors and demonstrators who explained to the people their respective advantages and distributed leaflets to selected people. Both the fairs were attended by the Superintendent who reports that our exhibits—especially the improved sugarcane—attracted considerable attention and excited a good deal of interest. During next year it is proposed to organise one or two exhibitions—if they can be so called—in each subdivision in a more systematic way in connection with these fairs.

The whole staff worked well and there has been a distinct improvement among the demonstrators who now realise that their work lies mainly among cultivators. Credit is due to Maulvi Fazlul Haque for the zeal with which he threw himself into the work, which he had to carry on with a staff most of whom were new. Amongst the Inspectors Babu Prafulla Chandra Datta deserves mention for the steady work done in the Habiganj subdivision.

3. The Sylhet Seed Depôt is only eighteen months old, and this is the first report dealing with one complete year—the last report dealing with six months only. During this period its activities have rapidly extended and the present godown is proving inadequate. The Depôt is being removed to the Northern bank of the river. Maulvi Fazlul Haque was in charge of the Seed Depôt throughout the year. He is assisted by a clerk, who has also charge of all his demonstration correspondence and accounts. A chonkidar also lives on the premises. The work of both the Seed Depôt and of demonstration is extending rapidly, and a whole-time clerk for the Superintendent is urgently wanted. As the staff is mostly new it is very important that the Superintendent should spend most of his time in touring.

One circular in Bengali regarding the cultivation of pulses was issued in October and another regarding the Kakaya Bomba jute seed was issued in February.

The Seed Depot transacted business to the value of Rs 19,942 0-5 and dealt with the following quantities of seeds, manures and implements :—

			Mds.	Rs.	Ch.
Potatoes	461	0 0
Pulses	75	0 0
Paddy	64	31 0
Jute	93	2 12
Cotton	0	59 4
Linseed	5	31 0
Mustard	3	87 8
Wheat	4	0 0
Oats	1	3 0
Bone-meal	982	35 0
Limestone	42	10 0
Water Hyacinth	8	29 0
Nitrate of Soda	2	30 0
Dhaincha	3	4 0
Cowpeas	60	39 4
Maize	0	32 0
Jowar	1	2 12
English vegetable seed	1,800	packets.
Pineapple suckers	100	plants.
Walnut and horse chestnut	100	seeds each.
Sunn-hemp	0	7 0
Meston ploughs	10	in number.
Rakes	2	" "
Sugarcane mills	11	" "
Pans	6	" "

Out of the 461 maunds of potatoes, 261 maunds were sold to the local public, 23 maunds supplied outside, 10 maunds to the Honorary Correspondents and 79 maunds used for demonstration purposes. About another 84 maunds was lost through rotting and wastage. Last year's potatoes were found to be more liable to rotting and disease both in the Khasi Hills and in the Surma Valley. But the heavy wastage was primarily due to the bad weather, as there were heavy rains immediately after the potatoes were brought down from Shillong, and they had to be

kept in stock for 15 days to one month. This is largely responsible for the deficit in the balance sheet. The bulk of the bone-meal 880 maunds—was sold in the Khasi and Jaintia Hills. The cultivators of the Surma Valley are mostly poor and illiterate and it was very difficult to approach them through the Sylhet Seed Depôt alone. As a matter of fact actual cultivators would never order in advance, for a seed they had not seen and would only take any seed just at the sowing time if it was available on the spot. The value payable system did not work very well, many people refusing to accept the V. P. although orders were placed beforehand. This entailed considerable loss to the Seed Depôt—specially in the case of perishable articles. As an experimental measure three sub-depôts were opened at Bejura, Chhatiai and Manik Kona. A Demonstrator was put in charge of the Depôts at Bejura and Chhatiai and an apprentice at Manik Kona (near Fenchuganj). Accommodation was provided by three local gentlemen, Babus Joynath Nandi, Honorary Correspondent, and Jagatpati Bhattacharya at the first two places and Munshi Maniruddin at Manik-Kona. They also rendered considerable assistance in the sale of seeds and our thanks are due to them. The accounts were all kept in the central Seed Depôt. The Seed Depôt at Bejura was a great success, where seeds to the total value of Rs. 2,519 was sold.

If we want to popularise improved seeds among actual cultivators we must have a permanent Seed Depôt like this in every important centre. Until this can be done it is desirable to stock enough seed at the headquarters of each Agricultural Inspector for the requirements of his subdivision just before the sowing period. People could then get the seed just when they wanted it and could see what they were paying for. This would also largely reduce the value payable system.

The accompanying balance sheet shows a loss of Rs. 1,251-11-5. The greater part of this loss is due to the heavy rotting of Shillong potatoes and to the bad germination of English vegetable seeds, for which a loss of Rs. 235 was incurred. Messrs. Sutton and Sons have, however, agreed to supply our present year's requirements at a reduced price, so that the loss will be recouped during the present year. In many cases (e.g., pulses and jute) seeds were sold at cost price without any contingencies being charged—which is responsible for the balance of the loss. It also includes Rs. 200 for the price of furniture.

Statement showing the working of the Sylhet Seed Depot for the year ending the 31st March 1920.

Assets or receipts.	Liabilities or charges.
	Rs. a. p.
Total amount realized from sale in year under report.	9,685 8 8
Deduct outstandings of last year realized in year under report.	<u>559 12 9</u>
Receipts of current year.	9,325 11 6
(a) Bills outstanding	323 14 0
Value of stores supplied to Honorary Correspondents at concession rates.	95 14 9
Value of stores supplied to the Farms and Demonstration.	2,403 15 8
Total sale proceeds	<u>12,149 7 6</u>
Rent ...	300 0 0
Establishment ...	396 0 0
Furniture ...	199 9 20
Contingencies including freights and packing charges.	538 8 2
Purchase of stores	15,246 0 8
Cost of stores received free from farms, etc.	1,808 9 9 (b)
Depreciation in value of stock in hand at 10 per cent. of cost price.	382 0 0
	<u>18,870 11 7</u>
Cost price of stock in hand on 1st April 1919.	1,169 12 4
Cost price of stock in hand on 31st March 1920.	3,821 5 0
Increase in stock	2,651 8 8
Add price of bone-meal advanced.	2,818 0 0
Total stock ...	5,469 8 8
Loss ...	<u>1,251 11 5</u>
Total expenditure	12,149 7 6

(a) The whole of this has since been realised.

(b) This amount includes Rs. 781-4-9 as value of bone-meal received from the bone-meal account.

Manufacture of bone-meal at Shillong.—The accounts of the Bone Manufacture at the Upper Shillong Farm was transferred to the Seed Depôt during the year. On the 1st April 1919 the stock in hand of raw bones amounted to 113 maunds and 13 seers; another 168 maunds and 25 seers was purchased and received in exchange during the year. Out of this, 184 maunds and 6 seers was crushed, leaving a balance of 87 maunds and 32 seers of raw bones in stock. The whole of the bone-meal valued at Rs. 806-1-6 was disposed of; 50 maunds and 21 seers being sold and the balance used at the Farm. The total cost of working was Rs. 467, of which Rs. 295 represents the cost of labour, oil, etc. The engine worked only for 13 days. Total sale-proceeds realised was Rs. 221-1-9. As the quantity of raw bones available for crushing in Shillong has always been too small for economically working the plant, it has been decided to discontinue the work at Shillong. Since the close of the year, the Bone Disintegrator has been sold to Messrs. Kilburn and Co., who have agreed to put it up at Sylhet on condition that the Department will have the first claim on the bone-meal produced.

4. Water Hyacinth.—This pest continues to spread in the low-lying districts of the Surma Valley, where it appears to have established itself four or five years ago.

The plant is a dangerous pest and grows extremely rapidly wherever water is available. Experiments made in Burma have shown that under favourable circumstances a single plant will develop at a pace sufficient to cover 300 square feet in four months.

The only known method of eradicating the Water Hyacinth is to pull it out of the water, dry it in the sun and then burn it completely. It was discovered by Mr. Finlow in Bengal that the ash was comparatively rich in potash and could be used as manure.

Details of the work done in 1917-18 and 1918-19 have been given in the last Annual Report and need not be repeated here.

It was decided that more vigorous steps should be taken on an extended scale to eradicate the weed.

The Director visited the infested area in the cold weather of 1918 and again during the rains of 1919, and after very careful consideration it was decided that the Department of Agriculture should set up an installation for extracting potash salt from Water Hyacinth ash with a view to testing the possibilities of recovering a part of the cost of burning the ash.

The actual work of burning the weed for the purpose of eradicating it was, under Government orders, entrusted to the Local Boards as it was evident that it was impossible for the limited staff of the Department to do anything beyond pointing out the ways.

Enquiries were made from several tea gardens by communicating with them direct, and also through the Scientific Officer of the Tea Association, if they required any Water Hyacinth ash. As a result, an order for 4,000 maunds ash to be supplied in February was received from Doom Dooma and another for about 200 maunds from Silchar.

The orders were communicated to the Local Boards and it was expected that the bulk of the ash would be supplied by them. Arrangements were also made with several contractors for the supply of ash.

During the rainy season of 1919, the Superintendent of Agriculture and myself, between us, visited all the worst affected water courses in the Surma Valley. It was clear that the pest interfered seriously with water courses but had done little damage to the *aman* paddy. Ultimately a place at Kaliarbhanza, 10 miles to the North-east of the subdivisional town of Habiganj, on the Habiganj-Nabiganj road, was selected for the installation for extracting potash. The place was a bazar, situated between two large *beels* connected by a natural canal. Another canal connected the *beels* with the Barak river, which is the main river in the subdivision. Both the *beels* and the *khals* were absolutely choked with the Water Hyacinth which formed almost a solid mass for several acres. It was also a good place for bringing the work to the notice of the people as the bazar drew large crowds on *hat* days.

Three installations were set up, one on a comparatively large scale with kerosine tins, one with a series of earthen *gawlas*, and another with baskets; the two latter with the object that they could be adopted by the cultivators in their own homes. (Baskets do not appear to be very suitable for the purpose, as the water percolated too rapidly, and handies are liable to breakage. One series with four kerosine tins seem to be the most suitable.)

Arrangements were made with the local people for the supply of ash which would be purchased on the basis of their

potash content, and the staff of the Department collected enough Water Hyacinth plant, to serve as fuel, the ash to be used again for potash extraction.

Collection of weeds was started in the middle of October, but after about one month's operations, all work had to be suspended for want of labour, the local people being all busy harvesting the *aman* paddy. A few labourers were imported from Sylhet, to dry the weeds already collected. In the middle of November there were some showers which considerably damaged the dry weeds. Work was again resumed in the beginning of January and some of the local people began to bring ash from the middle of the month which was analysed on the spot and paid for immediately.

From the beginning of February up to the end of March there were frequent rains accompanied by storms. The conditions were thus very unfavourable to the making of ash and interfered seriously with our operations. They were responsible not only for the small quantity of potash salt extracted but also for the low percentage of potash in the ash supplied in March and April.

The percentage of potash in the ash varied from 3 to 9 per cent.

The Local Boards failed to give any ash within February and on account of the unfavourable weather conditions, the quantity of ash supplied by the contractors was much smaller than was expected.

For the same reason, the cost of collection and drying as well as the cost of extracting the salt was very heavy and no suitable offer was received for the salt which was being produced. It was therefore decided to supply as much of the ash to the tea gardens as possible.

The total quantity of ash handled at the Kaliarbhanga installation was as follows:—

Supplied to Tea Gardens	...	810 maunds.
Used for making Potash	...	380 "
Supplied to the Tea Associations	...	10 "
Used for Demonstrations	...	15 " 80 seers.
Wasted by rain and storm and loss in handling.	186 "	
Total	...	1,401 maunds 30 seers.

In addition to the above the following quantities supplied by
18 Local Boards were sent to tea gardens :—

North Sylhet	...	...	75 maunds.
Habiganj Local Board	...	...	310 "
Sunamganj Local Board	...	...	320 "

The ash supplied by the Sunamganj Local Board was of
very poor quality.

The quantity of salt obtained was only 17 maunds 15 seers
or 48 per cent. whereas if the ash was fairly good, it should
have been at least 8 to 9 per cent. The cost of extracting the
potash salt, excluding capital charges, works out to Rs. 40 per
maund or Rs. 1092 per ton.

Although the actual amount of the salt or even of the
ash produced is not very great, the work attracted considerable
attention and has roused a good deal of interest among the people
of the locality. To what extent the extraction of potash salt
will repay the cost of production will depend on the price ob-
tained for the salt. There are indications, however, that the use of
the ash in the tea gardens might extend if it could be supplied
at the present rate, i.e., Rs. 6 per unit of potash per ton. Although
not a business proposition people may not be unwilling to supply
the ash at this rate to get rid of the pest. But as indicated
above, the main difficulty is about transport. This costs about
Rs. 1 per maund of ash, which the Government has paid during
the last three years. But it is doubtful, how long the Govern-
ment can continue to bear the expense. The most effective way
of destroying the pest is perhaps to teach the people of the localities
its use as manure particularly on jute. Large number of
demonstrations have been laid down during the present year for
the purpose.

5. Demonstrations in Khasia and Jaintia Hills—Staff.—
Mr. L. L. Reade was in charge of the agricultural demonstrations
in the Khasia and Jaintia Hills throughout the year. The Fruit
Inspector L. Harry Singh died on the 22nd August 1919 and
Mr. Reade has also been in charge of his duties since then. He
was assisted by four demonstrators stationed at Shillong, Umran,
Mawphlang and Jowai, respectively. The Agricultural Inspector
was on tour for 237 days and visited all important centres.
A good deal of his time was taken up in arranging for the dis-
tribution of bone-meal in the Hills and in the purchase and
despatch of seed potatoes for the plains. During the first two
months of the year, he was busy in arranging the transfer of the
bone-meal from Jowai to Jaintapur and its sale. From the
middle of August till the end of November, his main work
consisted of the purchase and despatch of seed potatoes.

6. The demonstrations consisted of the following items :—
 (1) Manurial demonstrations with paddy.
 (2) Introduction of superior varieties of paddy.
 (3) Trial of new varieties of paddy and miscellaneous crops.

Paddy manuring demonstrations.—The majority of paddy land cultivators of Jowai, Shillong and Mawphlang circles have now realised the value of bone-meal as manure for wet land paddy. Fresh demonstrations have been carried out only in a few centres where its value has not yet been fully realised. Altogether there were 6 demonstration plots of $\frac{1}{4}$ th acre each, the bone-meal being applied at the rate of 247 lbs. per acre.

First year's results of wet land paddy manurial demonstrations are given in the following table :—

No.	Locality.	Cultivators.	Yields of grain in pounds per acre.		Increase in pounds per acre.	Value of in- creased out- put after deducting the price of bone-meal.
			Bone-meal plot.	Untreated plot.		
I	2	3	4	5	6	7
1	Nongpoh	Basir Ahmed	1,625	1,598	485	Rs. 2. P. 7 13 0
2	Pynjal	Pring	1,494	1,610	65	10 8 6
3	Pynurkba	Rynshar	1,656	1,164	492	11 8 9
4	Kynsli	Junom	1,513	1,043	471	10 2 0
5	Lynjkiem	Ka Litti	1,110	893	233	-3 3 0
6	Mylliem	Wellington	1,468	1,172	356	3 7 3
		Average	1,612	1,108	495	6 11 8

The net profit per acre is Rs. 6-11-8 for the 1st year of application and any profit or increase obtained in subsequent year is pure profit.

The plots are being kept under observation during the present year.

The results of plots originally manured in 1918 were as follows:—

No.	Locality	Cultivators.	Yield of grain in pounds per acre,				Increase in pound per acre, in 1919.	Increase in two years.	Value of increased outturn of two years deducting the price of bone-meal.			
			1918.		1919.							
			Bone-meal plot.	Untreated plot.	Bone-meal plot.	Untreated plot.						
1	2	3	4	5	6	7	8	9	10			
1	Sohshrich ...	Rangmusuk.	1,695	820	1,479	989	491	1,366	60 2 8			
2	Jarin ...	Ka Tling ...	984	738	635	462	73	819	2 10 61			
3	Mawshuf ...	Ka Kyriup...	1,254	1,047	1,191	1,045	146	853	4 6 5			
4	Barapaci ...	D. Bopmay...	1,680	738	1,673	1,433	240	1,101	57 9 0			
	Average ...		1,383	636	1,219	982	238	785	31 3 4			

During the year, new demonstrations on upland paddy with bone-meal was carried out in 7 centres. The selected plots were about $\frac{1}{4}$ th acre each and were manured with bone-meal at the rate of 247 lbs. per acre before sowing. The results were as follows:—

No.	Locality,	Cultivator,	Yield of grain in pounds per acre		Increase in bone-meal plots.
			Bone-meal plot.	Untreated plot.	
1	2	3	4	5	6
1	Martgar ...	Ka Ngel	... ...	826	628 198
2	Nongrim Sadui	U Leu	... ...	759	471 288
3	Ramgakha ...	Phivik	... ...	308	151 157
4	Mairang ...	Suka	... ..	315	132 88
5	Nongpiar ...	Burahon	... ...	411	276 15
6	Mawryughnong	Kumar	... ..	415	359 64
7	Mowlang ...	Ingpal	... ...	751	580 168
	Average ...		... ...	526	398 140

Out of the 12 centres in 1918 where bone-meal was used for the first time, the results of 3 centres only were obtained, the cultivators of the other plots being unwilling to grow the upland paddy again on the same plots as little effect was seen on the first crop. Outturns were as follows :—

No.	Locality.	Cultivator.	Yield of grains in lbs. per acre 1918.		Yield of grains per acre in lbs. 1919		Increase during the year.	Total increase in 2 years.	Value of in- creased outturn after ad- ding the price of bone- meal.
			Bone- meal.	Untreat- ed.	Bone- meal.	Untrea- ted.			
1	2	3	4	5	6	7	8	9	10
1	Nomgmasi...	Sad ...	1,440	1,280	1,057	963	124	284	Bi. a. p.
2	Sohlong ...	Hirson ...	1,026	913	673	584	89	202	-3 1 0
3	Mowlong ...	Ka Eu ...	1,100	833	495	464	31	284	0 12 0
		Average yi- elds per acre.	1,190	1,015	751	670	81	250	-0 5 0

No cultivator could be persuaded to grow upland paddy on the same land for this year on plots manured in 1917 and hence the results of bone-meal for three years could not be obtained.

Judging from the results of the last four years, bone-meal does not appear to be a profitable manure for upland paddy. With the object of testing whether the application of a soluble nitrogenous manure would improve the outturn, a few plots were manured with bone-meal and subsequently top-dressed with sodium nitrate. The results obtained are not very hopeful, but they will be continued for another year.

7. *Distribution of Bone-meal.*—One thousand four hundred and fifty maunds of bone-meal was purchased during 1918-1919 the bulk of which was sold within March 1919. Another 176 maunds was sold from the Upper Shillong Farm.

Out of last year's consignment, 450 maunds were sold during the year under report and applied to the present paddy crop.

The demand for bone-meal is very keen, specially among the cultivators of Jowai. Unfortunately owing to the heavy demand

from Japan and other European countries, it has been very difficult to obtain any bone-meal at a reasonable price. Prices have gone up to over Rs. 6 per maund at Calcutta but through the good offices of Mr. McKay to whom the thanks of the department are due special rates were secured for this department. Although, however, the order was placed as early as January the bone-meal has been received only in April since the close of the year under report. The bone-meal is being rushed up to Shillong and Jowai and is hoped to reach the cultivators before the paddy is transplanted. At Jowai an arrangement has been made to sell the bone-meal through contractors as it was otherwise found very difficult to arrange for the conveyance of the bone-meal from Jaintiapur to Jowai. The price is fixed by the department, and the contractor receives a commission. The arrangement so far is working quite satisfactorily.

8. *Potatoes*.—During the year under report 72·52 tons (1,958 maunds) were supplied as against 43 tons (1,150 maunds), during the previous year and were distributed as follows :—

	Tons.
From Shillong to Gauhati Seed Depôt ...	45·81
„ Ladmauphang and Cherra to Syll et ...	14·30
„ Shillong direct to places outside the district ...	1·95
Issued to cultivators in the district ...	·77
" " on return system to Shillong and Mauphang circle.	9·32
" " for demonstrations ...	·37
Total ...	72·52

Within the last three years, the demand for improved seed potatoes from the plains has nearly quadrupled. It is impossible to meet this demand with the seed grown at the Upper Shillong Farm. With the object of increasing the supply of improved seed, a scheme was started last year by which selected Khasi cultivators undertake to grow on their own lands, seed potatoes supplied by the Farm. The seeds are supplied free on the cultivator entering into an agreement to keep the seed pure and return to the department one and a half maunds for each maund of seed supplied. He also undertakes to sell the whole of his crop to the Department at the prevailing market rates. During last year 150 maunds were issued to the cultivators according to

this system and 207 maunds were recovered. In a very few cases there were only partial or no recoveries as the crops were partial or total failures. The seed was sent to the Gauhati Seed Depôt. One hundred and fifty six maunds have been distributed according to this system during the present year.

Demonstrations with summer potatoes of improved varieties were conducted in 12 centres with the following results:—

No.	Locality.	Cultivator.	Yield in pounds for every maund (82½ pounds) supplied.
1	2	3	4
1	Mawlong	William	1,182
2	Demthring	Kidon	441
3	Mutlang	Simon	416
4	Kyndong Tuber	Riang	1,086
5	Tarain	Khun	522
6	Jowai	Bishop's boarding school	246
7	Jowai	Jones Passah	112
8	Latuber	Shai	430
9	Myso	Howel	963
10	Wahiajer	Rabot	1,236
11	Ummolong	Jem	990
12	Puriang	Dorka	508
13	Kynstu	Shim	411
14	Laikynsew	Shon	430

Spraying with Bordeaux and Burgundy mixtures.—Owing to the high price of materials no spraying demonstration was carried out during the last potato season. The demonstrations will be continued during the coming season.

Paddy experiments.—Experiments were conducted in the fields of selected cultivators with Naga paddy, Bhutia paddy, Dumai paddy, Mansiat Khumuj (Khasi Hills) paddy and Indra sail. The results varied very widely but some of the results were quite encouraging. They are being continued during the present season.

Trial of miscellaneous crops.—Small quantities of ground-nuts were tried in a few places and did well on the lower levels. They were not, however, a success in the upper portions of the hills.

Garo cotton was tried in the Jowai and Umran circles but germination was not satisfactory and the crop was not a success.

Ploughing demonstrations.—Ploughing demonstrations with the Meston plough were carried out at Kyndem, Umsning and Nongpoh. The Meston plough is however too light for the dry upland cultivation.

During the year one Turnwrest plough was purchased at cultivators' expense and necessary assistance was given by the staff in using the plough at Marngar.

Insect Pest.—During the year, a new pest, which seems to be very destructive, appeared on paddy crops at Rambrai and Mawdem in very great swarms, and specimens were collected and sent to the Entomological Assistant, Assam.

9. *Demonstrations in fruit growing.*—L. Harry Sing took up the duties of the newly created post of Fruit Inspector towards the end of March 1919. Unfortunately he fell ill in July before he was fairly stared in his work and died in August. His duties fell on the Agricultural Inspector who could devote only a small part of his time to this work. The progress was therefore much less than could have been desired. With a view to introducing the improved fruit trees which have been thoroughly tested at the Fruit Experiment Station and can be now safely recommended as immensely superior to the local varieties, a scheme was drawn up—in consultation with the Hon'ble Mr. C. H. Holder for starting experimental orchards in six representative sites. Mr. Holder kindly examined some of the sites. During the winter of the year under report a few apple and pear grafts have been planted in the orchards under the personal supervision of the Agricultural Inspector. The cultivators provide all the land and the labour and agree to carry out the instructions of the Departmental Officers.

10. *Supply of plants, seeds, etc.*—The following plants and seeds were supplied during the year:—

Orange seedlings	...	...	...	500 plants.
Orange seeds	...	...	...	2 lbs.
Pear grafts	...	...	...	9 plants.
Apples	...	...	...	2 "
Cryptomeria Seedlings	...	...	...	320 "
Maine	...	...	...	19 eobs.

Vegetable seeds	...	...	...	553 packets.
Arrowroot tubers	...	...	...	24 lbs.
Coffee seeds	...	...	...	20 "
Yam	...	...	...	90 "

Considering that this was his first year of independent work as an Inspector, Mr. Reade worked quite well. The new demonstrators, however, require a good deal of supervision.

SYLHET, } J. N. CHAKRAVARTY,
The 25th April 1920. } Offg. Deputy Director of Agriculture,
Surma Valley and Hill Districts.

SYLHET,

J. N. CHAKRAVARTY.

*Offg. Deputy Director of Agriculture,
Surma Valley and Hill Districts.*

25th April 1920.]

A. S. P. O. (D. L. R. & Agri.) No. 11-415-10.9-1920-A. E. E.

CONTENTS.

REPORT OF THE JORHAT EXPERIMENT STATION FOR THE YEAR ENDING THE 31ST MARCH 1921.

	PARA.	PAGE.
Introduction	1	1-2
Soil	2	2-4
Buildings, machinery, etc. ...	3	4
Rainfall	4	5
Experimental work ...	5	5-6
Sugarcane ...	6	6
Sugarcane, varieties, ratoons ...	7	6-11
Ditto, plant cane ...	8	12-17
New varieties of cane ...	9	18
Soil investigations ...	10	18
Lime experiment, Block G ...	11	18
Lime and manurial experiment, Block C ...	12	19
Wood ashes experiment ...	13	19
Ground limestone experiment, Block L ...	14	19-21
Experiment on the functions of lime, Block K ...	15	21-22
Mineral phosphate experiments in the sugarcane rotation, Blocks A, B, D and E	16	22
Pulse crops ...	17	22-23
Fodder crops ...	18	23-24
Extension area ...	19	24
Other crops ...	20	25
Orchard ...	21	25
Receipts and Expenditure ...	22	25-26
Establishment ...	23	26
Inspection ...	24	26
Acknowledgment ...	25	26

REPORT OF THE UPPER SHILLONG AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE 31ST MARCH 1921.

	PARA.	PAGE.
History and description ...	1	27
Purposes of the station ...	2	27
Weather ...	3	28
Summary of work... ...	4	28

(ii)

	PARA.	PAGE.
Trial of varieties of potatoes ...	5	28-33
Sprouting seed potatoes ...	6	33-34
Potatoes for seed ...	7	34-37
New crops ...	8	37
Fodder crops ...	9	38-39
Cattle breeding ...	10	39-40
Distribution of seeds and plants ...	11	40
Establishment ...	12	40-41
Receipts and Expenditure ...	13	41

REPORT OF THE FRUIT EXPERIMENT STATION, SHILLONG,
FOR THE YEAR ENDING THE 31st MARCH 1921.

	PARA.	PAGE.
Introductory ...	1	42
Lower garden ...	2	42
Upper garden ...	3	43-48
Varieties planted ...	4	48-59
Statement of Receipts and Expenditure ...	.....	79

REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT
STATION FOR THE YEAR ENDING THE 31st MARCH 1921.

	PARA.	PAGE.
General ...	1	71
Character of land and soil ...	2	71-72
Reclamation, construction and repairs ...	3	72-73
Cattle ...	4	73
Weather ...	5	73-74
Rice breeding ...	6	74-75
Minor experiments ...	7	75-79
Jute ...	8	79-81
Improved Sugarcane varieties...	9	81
Cold weather crops ...	10	81-82
Non-experimental crops ...	11	82-83
Insect pests ...	12	83
Receipts and Expenditure ...	13	84-85
Staff ...	14	85
Apprentices ...	15	86

REPORT ON AGRICULTURAL DEMONSTRATIONS IN THE
ASSAM VALLEY CIRCLE FOR THE YEAR ENDING THE 31ST
MARCH 1921.

	PARA.	PAGE.
Staff ...	1	87—89
Demonstration work in the Assam Valley ...	2	89
Rice, manurial demonstrations ...	3	89—95
Rice, superior varieties ...	4	95—96
Sugarcane varieties ...	5	96—97
Sugar mills and <i>gur</i> -boiling pans—	6	98—99
Jute demonstrations ...	7	99
Potato demonstrations ...	8	99—101
Demonstration with miscellaneous crops ...	9	101—102
Conservation of cowdung, etc....	10	102
Agricultural work in the Sadiya Frontier Tract ...	11	102—104
Agricultural work in the Garo Hills ...	12	104—105
Work of the seed depôt, Gauhati ...	13	105—108
Work of Honorary Correspondents ...	14	108

REPORT ON AGRICULTURAL DEMONSTRATIONS IN THE
SURMA VALLEY CIRCLE FOR THE YEAR ENDING THE
31ST MARCH 1921.

	PARA.	PAGE.
Staff ...	1	109—110
Agricultural Conferences and Fairs ...	2	110—112
Summary of work done ...	3	112—113
Demonstrations during the year ...	4	113
Manurial Demonstrations on paddy ...	5	113—116
Introduction of superior varieties of paddy ...	6	116—117
Jute ...	7	118
Sugarcane ...	8	118
Potatoes ...	9	118—119
Pulses and oilseeds ...	10	119—120
Water Hyacinth ...	11	120
Trials of new crops ...	12	121
Introduction of iron mills and shallow pans ...	13	121
Miscellaneous ...	14	121
Report of the Sylhet seed depôt ...	15	121—124
Demonstrations in the Khasi and Jaintia Hill ...	16—23	124—131

GLOSSARY.

Arhar...	...	... <i>Cajanus Indicus.</i>
Aus ...	...	... Autumn rice.
Asra ...	...	... A short stemmed variety of deep water winter rice.
Aman...	...	... A long stemmed deep water paddy.
Boro ...	...	... Transplanted summer rice.
Cowpea	...	... <i>Vigna catieng.</i>
Dhaincha	...	... <i>Sesbania aculeata.</i>
Groundnut	...	... <i>Arachis hypogaea.</i>
Gram...	...	... <i>Cicer arietinum.</i>
Jowar...	...	... <i>Andropogon sorghum</i> var. <i>vulgare.</i>
Kharif	...	... The rainy season.
Kalai...	...	... <i>Phaseolus mung</i> var. <i>radiatus.</i>
Kehsari	...	... <i>Lathyrus sativus.</i>
Masur	...	... <i>Lens esculenta.</i>
Mung...	...	... <i>Phaseolus mungo.</i>
Oats ...	...	... <i>Avena Sativa.</i>
Paddy...	...	... <i>Oriza Sativa.</i>
Peas ...	...	... <i>Pisum Arvense.</i>
Rape ...	...	... <i>Brassica Campestris.</i>
Sugarcane	...	... <i>Saccharum officinarum.</i>
Sail ...	...	... Transplanted winter rice.
Tola ...	...	... .0258 lbs.
Wheat	...	... <i>Triticum vulgare.</i>
Beer seens	...	... <i>Trifolium alexandrinum.</i>
Raishan	...	... <i>Paspalum Sanguinale.</i>
Maund	...	... 82½ pounds.
Jhum...	...	... A system of cultivation consisting of paring and burning the surface.
Kulthikalai	...	... <i>Dolichos biflorus.</i>
Soy bean	...	... <i>Glycine hispida.</i>
Guinea grass	...	... <i>Panicum jumentorum.</i>